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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION AND THE DENTAL COSMOS

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The St. Louis Meeting
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COUNCIL ON DENTAL THERAPEUTICS

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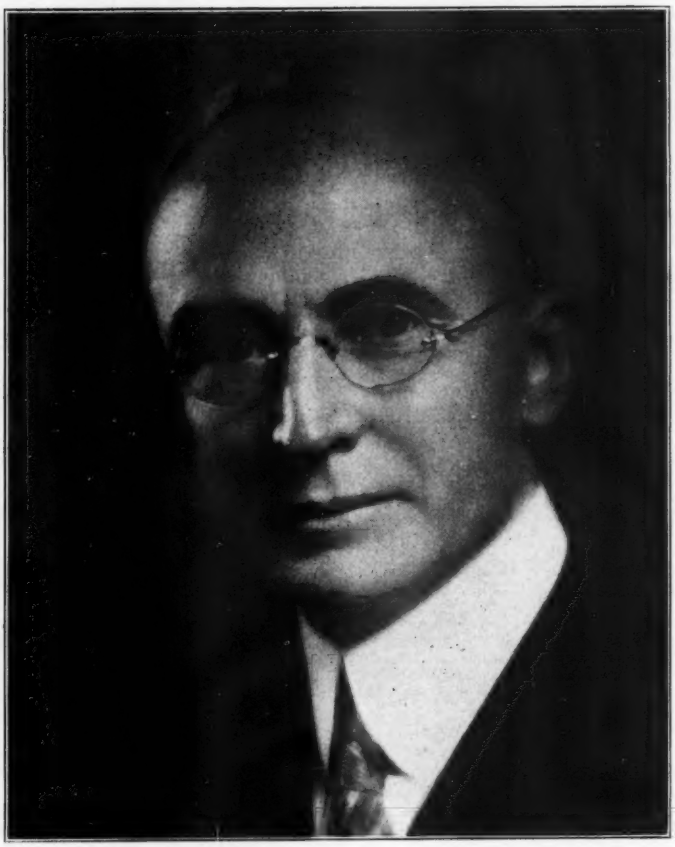

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CENTRAL GIANT-CELL TUMORS OF THE JAWS

By GLENN MAJOR, D.D.S., M.D., Ph.D., F.A.C.S., Pittsburgh, Pa.

ONE of the most imperfectly understood neoplasms of bone is the so-called benign giant-cell tumor. The possibility of its benignity may be questioned, and indeed many would even exclude it from the category of tumors. The central giant-cell tumor of the maxillae and mandible is essentially the same lesion as that occurring in other bones of the skeleton. However, the exact relationship between this neoplasm and the giant-cell epulis is a little obscure. The present discussion is not concerned with the latter.

TERMINOLOGY

Our knowledge of giant-cell tumor dates from the brilliant work of Nélaton in 1860, when he emphasized the benign nature of the growth and termed it *tumeur à myéloplaxes.* As was the case with most bone tumors prior to the work of the Committee for the Registry of Bone Tumors of the American College of Surgeons, various terms were employed to designate identical lesions. The benignity emphasized by Nélaton had been forgotten for almost half a century. From 1870 until 1910, the term "myeloid sarcoma" was in common usage, as was also the contradictory designation of "benign giant-cell sarcoma." In 1910, Bloodgood[1] called attention to the benign nature of the tumor, and, in 1912,[2] called the neoplasm a "benign giant-cell tumor," which continues to be the accepted term. Barrie, Ewing, Kolodny,[3] Meyerding and others have also popularized the concept that this lesion is benign, while Freund and Meffert, and Cotton have believed that we have become entirely too complacent concerning it.

From the Western Pennsylvania Hospital.

NATURE OF THE TUMOR

It is a noteworthy fact that the true nature of the giant-cell tumor is still a moot question. One school would consider it a true neoplasm, whereas the other ascribes it to a regenerative process whose end-effort is the restoration to normal of areas already destroyed by some injurious condition; in other words, a faulty repair phenomenon. Barrie thus termed it a hemorrhagic osteomyelitis, but conceded that the etiologic agent responsible for the bone destruction is unknown. Others believe that trauma is

responsible for the osteolysis. It must be admitted that whatever the opinion of a given investigator may be as regards the genesis of tumors in general, and sarcoma in particular, trauma seems to at least play a part. Kolodny[4] believed that the effects of trauma, the repair and regeneration of tissues, the separation and the isolation of cell complexes, hemorrhage with subsequent absorption and encapsulation and the necrosis of tissue are all likely to play a part in the etiology of mesoblastic tumors, when brought together with certain predisposing factors. Geschickter and Copeland,[5] who have done such admirable work on bone tumors, believe that the giant-cell tumor represents the end-result of an imbalance of two normal repair processes: an unusual increase in osteoclastic proliferation on the one hand and a diminution or suspension of new bone formation in an injured cortex on the other. Although it must be granted that the inflammatory or reparative theory has gained ascendancy in recent years, there are still those who cling to the neoplastic theory and consider the giant-cell tumor as a definite neoplasm. Among the adherents to this latter concept are Kolodny,[3] Pierce[6] and Stone and Ewing.

RELATION TO OSTEITIS FIBROSA CYSTICA

The giant-cell tumor seems to bear a definite relationship to osteitis fibrosa cystica, although it is not clear how intimate that connection is. As Simmons and Kolodny[4] have shown, the older giant-cell tumors present evidence of fibrosis, as the result of advancing age, treatment or fracture. Barrie considered the solitary bone cyst, osteitis fibrosa cystica and giant-cell tumor as different phases of the same process—an attempt at repair following bone destruction. Geschickter and Copeland[7] have postulated that a bone cyst occurring in the metaphyseal region of one of the long bones of a young person represents a healing phase of giant-cell tumor, a conclusion based on clinical, pathologic and anatomic observations, and demonstrated by an analysis of numerous transitional lesions between these two entities.

MULTIPLE GIANT-CELL TUMORS

Multiple giant-cell tumors are prone to be associated with a tumor of the parathyroid glands. Alexander and Crawford collected four cases from the American and seven from the foreign literature of multiple giant-cell tumor. These authors quoted a communication from Codman in which he stated that he was skeptical about the existence of such a condition. Pfahler and Parry reported a case of what appeared to be a giant-cell tumor of the mandible, which later developed multiple bone tumors. Subsequently, a parathyroid tumor was found. Biopsy was not made on any of the bone tumors. Kolodny[4] has been of the opinion that in the apparent multiple giant-cell tumors, one is probably dealing with osteitis fibrosa cystica. Geschickter and Copeland[5] have cited the work of Jaffe in which he showed that an experimental increase of the parathyroid hormone does not cause development of multiple tumors of the true giant-cell type, although giant-cell areas and osteitis fibrosa-like tissue may be formed in the bones of animals fed an excessive amount of this substance.

FREQUENCY

Although central giant-cell tumor of the jaws is one of the more unusual mouth tumors, the mandible is one of the more common sites of this lesion, as shown by Pfahler and Parry. An occasional case is seen in the maxillae. In a series of eighty-four cases at the Mayo Clinic, listed as to location, Kirklin and Moore reported nine occurring in the maxillae and seven in the mandible. In most series of cases, the mandibular tumor predominates. Thus, 19 per cent of

the giant-cell tumors of this series occurred in the jaws.

AGE AND SEX INCIDENCE

The majority of cases are seen in early adult life. Geschickter and Copeland[3] estimated that 40 per cent occur in the third decade, and Kolodny[4] believed that the lesion is most common between the ages of 15 and 25. There is no special sex predilection, although in Simmons' series females predominated.

SYMPTOMATOLOGY

The presence of the tumor is indicated by few symptoms and these usually very mild. A history of trauma can often be elicited and is undoubtedly of considerable importance in the production of the lesion. Pain is not a prominent feature, though the patient will frequently complain of slight fullness or discomfort. Since the tumor is a central one and is expansile, there is bulging of the bone in question. In the case of the mandible or the maxillae, this bulging is usually felt over the buccal or labial plates, the lingual aspect of the mandible and the palatal aspect of the maxillae being relatively more resistant to the progress of the tumor. The mucous membrane overlying the expanded cortical bone is usually deep red, or even purple. The expanded cortical shell often crepitates under the examining finger, a sensation resulting similar to that experienced on cracking an eggshell with the finger. Tenderness is slight, or even absent. In some cases, the neoplasm has progressed to such size that there is external deformity of the face. Because of the bone destruction occasioned by the tumor growth, pathologic fracture may occur through the tumor site. Indeed, it is sometimes the first symptom experienced by the patient.

ROENTGENOLOGIC FINDINGS

Most roentgenologists believe that the roentgenograms of giant-cell tumor are characteristic. Typically, it produces a bulky, roughly spherical or ovoid shadow, the margins of which are fairly well demarcated. The defect is not smoothly circular in outline, but here and there lobulations are present. Incomplete trabeculae are usually visible near the periphery of the tumor. There is no periosteal reaction and the cortical bone and the periosteum beyond the confines of the tumor appear normal. The latter is never separated from the uninvolved bone. Ordinarily, though the cortical bone is expanded, it is not penetrated by the tumor mass. Figure 1 is an example of the typical roentgenogram.

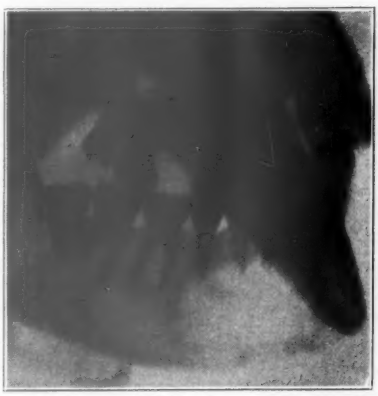

Fig. 1.—Typical giant-cell tumor of mandible.

Kirklin and Moore have described roentgenologically a second variant in which there is homogeneous bone destruction, the cortex is not expanded but is dissolved and the tumor projects into the soft tissues. This might easily be mistaken for primary bone sarcoma or a metastatic growth. As regards diagnosis, many investigators, including Herendeen, Pfahler and Parry and Peirce, believe that the roentgenograms are equal to or even superior to microscopic sections of the tumor. However, an absolute diagnosis cannot be made from the roent-

genograms alone. Herendeen reported a case which Kolodny presented in his exhaustive article on the subject. The case was originally presented as typical of benign giant-cell tumor of one of the long bones. One year later, the patient developed a second tumor of the mandible, apparently by metastasis. Coley[9] described six cases of sarcoma developing in what appeared roentgenologically to be benign giant-cell tumor. He stated that it is impossible to make a diagnosis of benign giant-cell tumor from the clinical and roentgenologic evidence alone; and there is one chance in five that the tumor may prove to be malignant.

GROSS PATHOLOGY

As already intimated, the true pathology of this lesion is but poorly understood. Geschickter and Copeland[8] thought that the tumor begins subcortically and extends into cancellous bone. The absence of periosteal reaction is characteristic. The growth is expansile and not primarily infiltrative. It consists of solid portions, as well as of small cystic areas. The solid portions are crumbly, friable and granular, varying from dark red to yellow, and the typical sections of the tumor resemble currant jelly. Extension into the temporomandibular joint is extremely rare. The appearance of the neoplasm has been compared to that of an old bruise. Occasionally, the entire tumor is encapsulated by fibrous tissue, and sometimes fibrous areas can be palpated in the gross specimen. The tumor is not adherent to the surrounding bone and may be easily separated from the tumor-bearing area by instrumentation.

MICROSCOPIC PATHOLOGY

Microscopically, the lesion is found to be made up of two components: giant cells and stroma cells. The multinucleated giant cells are loosely embedded in a stroma of smaller rounded spindle and polygonal cells with large vesicular nuclei. The stroma is well supplied with blood vessels, and thin walled capillaries and newly formed vessels are numerous. Under low power magnification, the fields will average about thirty giant cells, each with from fifteen to 200 nuclei, the cell outlines of which are often indistinct. Areas of hemorrhage are frequent. Around such areas, as well as around spicules of bone, the giant cells are most numerous. Zones are often present in which there has been partial organization of the areas of hemorrhage. The origin of the giant cells is a matter of conjecture. It is undoubtedly true that the malignant potentialities of a given tumor of this type are more dependent on the nature of the stroma cells than on that of the giant cells. In those cases in which the bulk of the tumor is composed of giant cells, the prognosis, from a microscopic standpoint, is best. As the giant cells disappear and the cellularity of the stroma increases, the aggressiveness of the tumor increases.

It is a well-known fact that wide variance of opinion exists as to the value of microscopic diagnosis in this type of tumor. At present, the general trend of opinion is to consider diagnosis based on microscopic examination unreliable and to admit that the future behavior of the tumor cannot be predicated on such examination, as shown by Simmons, Herendeen, Holland and Codman. Kolodny[3] believed that, in the microscopic diagnosis of giant-cell tumor, a guarded prognosis should be given in cases in which the tumor is very vascular or telangiectatic or the stroma cells near the periphery of the tumor show marked pleomorphism. Also, if the stroma cells are particularly rich in chromatin, the prognosis should be guarded.

In general, the diagnosis and the prognosis of a given case of giant-cell tumor should be based on the clinical, roentgenologic and microscopic findings (provided the latter is deemed advisable.) It is generally conceded that many variants

of the giant-cell tumor exist, as Kolodny[3] has pointed out. Stone and Ewing recognized various grades of malignancy in this group of tumors, but did not feel justified in including the atypical forms among the malignant osteogenic sarcomata. Furthermore, Ewing did not believe that such cases should be subjected to biopsy.

METASTASIS OF GIANT-CELL TUMORS

In the literature, many references to metastasis of giant-cell tumors have been cited. Simmons mentioned four cases in which death occurred from metastasis. Coley[10] reported fifty cases, nine of

Fig. 2.—Case cited in text; roentgenogram taken prior to first biopsy.

which metastasized. However, in an analysis of the data published by various authors, it is found that such tumors have changed type prior to metastasis. For all practical purposes, it may be said that a giant-cell tumor in its original form never metastasizes.

SARCOMA ARISING IN GIANT-CELL TUMORS

Opinion is almost unanimous that a certain percentage of tumors indistinguishable from the giant-cell group give rise to sarcoma. Geschickter and Copeland[7] believe that the tumor is benign and state that the possibility of malignancy is very remote. Kirklin and Moore, in a study of 110 cases of giant-cell tumor observed at the Mayo Clinic over a twenty-year period, were unable to find a single case in which metastasis or malignant degeneration developed. In eighty-six of the cases, the diagnosis was proved by biopsy or by operation. However, Stone and Ewing have reported a case in which malignant transformation occurred in a giant-cell tumor. Peirce[6, 11] presented two such cases. Kolodny[3] recognized the possibility, and Simmons stated that the giant-cell tumor became an osteogenic sarcoma in 3.7 per cent of his cases.

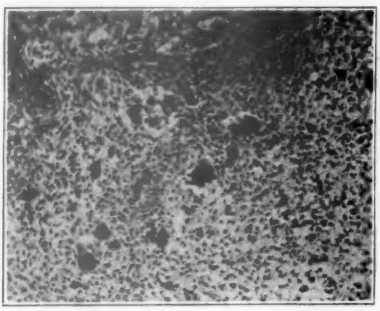

Fig. 3.—Giant-cell tumor. (×120.)

EXAMPLE OF MALIGNANT TRANSFORMATION

One of our cases of giant-cell tumor has proved to be an interesting example of malignant transformation, this being the only case of malignancy developing in a series of fifteen central giant-cell tumors of the mandible and maxillae. A white woman, aged 47, gave a history of trismus, swelling and slight discomfort over the region of the right ramus of the mandible of one month's duration. She had lost no weight and was in an excellent state of nutrition. The roentgenogram is shown in Figure 2. It will be noted that the picture is not typical of benign giant-cell tumor of the classical

type, but could fit into Class II of Kirklin and Moore. There is only the slightest suggestion of trabeculation; the anterior outline of the tumor is indefinite and merges with normal bone, and the bone over the crest of the alveolus has been destroyed. Biopsy (frozen section) led to a diagnosis of benign giant-cell tumor. Photomicrographs are shown in Figures 3 and 4.

It is apparent in the high power magnification that the stroma is rather rich in chromatin, but still the tumor should be placed in the category of benign giant-cell tumor from a microscopic standpoint. The cavity was thoroughly exposed, the tumor tissue removed by curettage and

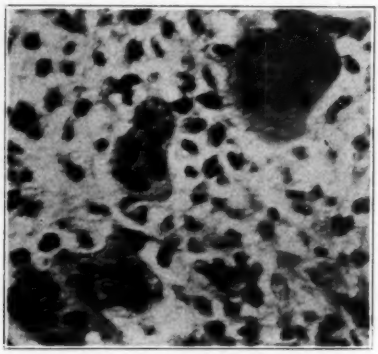

Fig. 4.—Giant-cell tumor. (×520.)

the tumor-bearing area thoroughly treated by electrocoagulation. The patient seemed to do well, with no apparent recurrence of the tumor for five months, when there was rapid increase in the size of the ramus of the mandible. Biopsy at this time revealed fibrosarcoma, the photomicrographs of which are shown in Figures 5 and 6. It will be seen that the architecture of the tumor had changed completely.

DIFFERENTIAL DIAGNOSIS

The giant-cell tumor, an expansive type of growth, must be differentiated from similar lesions occurring in the maxillae and mandible. The differential diagnosis of this tumor in the jaws is not different from that of the long bones, except as far as several tumors indigenous to the jaws must be considered.

A dentigerous cyst occasionally offers some difficulty in the differential diagnosis. An unerupted tooth is always associated with the dentigerous cyst, and the cyst is unilocular with no trabeculae. However, sometimes a giant-cell tumor may lie adjacent to an impacted tooth. In general, the outline of the dentigerous cyst is more regular, and more commonly is associated with an unerupted upper cuspid or with an impacted lower third molar. Again, the dentigerous cyst is lined with stratified squamous epithelium.

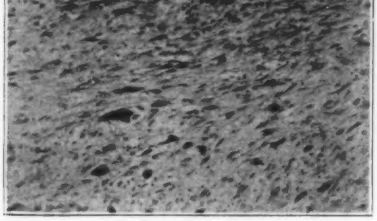

Fig. 5.—Fibrosarcoma. (×120.)

The radicular cyst ordinarily offers no great diagnostic problem, but ocasionally the cyst attains large size and apparently loses its connection with the non-vital tooth from which it originated. The finding of vital teeth in the region of the tumor obviates the diagnosis of radicular cyst. This particular tumor is most commonly found in the upper lateral incisor area. The outline of the cyst is usually regular, and it, too, is lined with stratified squamous epithelium.

The adamantine neoplasms are quite difficult to differentiate from giant-cell tumors. Because of the trabeculation, the multilocular adamantinoma may simulate

the giant-cell tumor very closely. However, the adamantinoma is much slower in its development. The trabeculae are more clearly defined and usually extend throughout the tumor cavity, unlike those of the giant-cell neoplasm, in which the trabeculations are inclined to be hazy and incomplete. Microscopically, the adamantine epithelium is characteristic.

The nasopalatine duct cyst may occasionally be confused with giant-cell tumor. In the former, the lesion always occurs in the anterior portion of the maxillae, and it is unilocular or may occasionally be bilateral. Like the other cystic tumors of the jaws, it contains fluid, or sometimes a semisolid material. It is lined with either columnar or squamous epithelium, the type depending on its origin; i.e., whether nasal or oral.

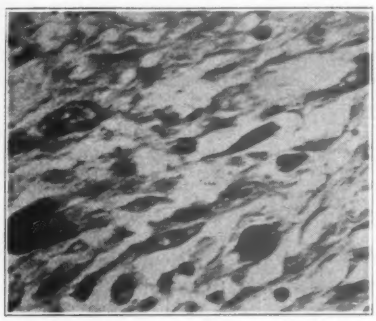

Fig. 6.—Fibrosarcoma. (×520.)

Osteogenic sarcoma offers diagnostic difficulty at times. However, in this tumor, the periosteal reaction is usually evident; the reactive triangle of Codman is often present; the tumor is rapid in its development, and, microscopically, most or even all of the successive stages of bone formation are demonstrable.

A central sarcoma, such as a fibrosarcoma, sometimes offers considerable difficulty, and often a microscopic section is necessary to differentiate the two conditions. I recently removed a fibrosarcoma of the mandible in which the cortical bone was expanded but was still intact. There was no periosteal reaction, and the area of osteolysis simulated very closely that of a giant-cell tumor.

The giant-cell tumor may resemble the region in which lysis is seen in central carcinoma of the mandible, or occasionally may even resemble carcinoma of the maxillary sinus. Often, the age of the patient will aid in establishing the diagnosis, but occasionally this cannot be made until after a biopsy. The presence of a carcinoma of the prostate, thyroid gland or breast or a hypernephroma will be of aid in ruling out the possibility of metastatic carcinoma.

Giant-cell tumor is sometimes confused with central fibroma. In the latter, the growth is usually more tardy in its development, and the trabeculation is usually lacking. Fibro-osteoma should not be confused with giant-cell tumor, since the lesion in the latter is entirely osteolytic. Likewise, central osteoma offers no diagnostic difficulty. Multiple myeloma should not be confused with giant-cell tumor, and the uncommon solitary plasmocytoma will rarely be mistaken for it.

TREATMENT

The question of treatment in this group of tumors has occasioned much discussion during the past few years, the chief contenders being the surgeons on the one hand, and the radiologists on the other.

Coley[12] was of the opinion that the tumor should be removed by curettage and the tumor cavity treated with zinc chloride. Cotton believed that surgery is preferable to x-ray therapy in all but the spinal cases of giant-cell involvement. Geschickter[13] stated that surgery is preferable to irradiation in cases in which the involved bone is not essential to the function of the limb, as in the fibula, ulna or rib; in cases in which limb function is vital to carrying out the occupation of the patient, since irradiation ef-

fects are secured more slowly than those by surgery, and, finally, in cases which have been treated inadequately elsewhere, and where there is recurrence of the tumor. Geschickter and Copeland[8] stated that "curettement properly performed in carefully selected cases is unquestionably the treatment of choice." Bloodgood[14] held that irradiation is more uncertain than curettement and the effects are often more prolonged, and that irradiation does not offer the advantage of a microscopic diagnosis in doubtful cases. He recommended resection in preference to curettement only when such a procedure is made necessary by the absence of the bony shell, or when resection will leave the part with equally good function. Coates believed that resection of the maxilla was justifiable in giant-cell tumor of the maxilla.

In our clinic, it has been the practice to perform curettage, following this with thorough electrocoagulation of the tumor-bearing area.

One of those who are definitely against surgical treatment is Ewing. He has made the statement that "at the present time, the prognosis for a patient with giant-cell tumor in this country is comparatively unfavorable, owing to the unfortunate results of surgical interference." He believed that the surgeon should not be called on to treat these cases. Many investigators believe that surgical trauma is sufficient in many cases to cause the transformation of a benign into a malignant tumor.

Probably, irradiation is the most popular therapy for this group of tumors. Among the many advocating this method are Peirce and Lampe, Herendeen, Pfahler and Parry, Soiland and Castolow. However, the irradiation must be adequate, since imperfect irradiation may be the insult which causes the malignant transformation. The trend at present is to smaller and more frequent doses of irradiation.

Whereas, formerly, surgery was frequently followed by irradiation, current opinion is opposed to the combination of the two methods and enters a plea that one or the other be adhered to. As Coley and Higinbotham have said, "For reasons not clearly understood, curettage and irradiation do not form a desirable combination in the treatment of giant-cell tumor." Although Peirce[6] formerly favored the combination of the two methods, in an article with Lampe he stated that adequate curettage, with or without cauterization, has been as effective as curettage with irradiation.

CONCLUSIONS

An adequate explanation of the histogenesis of giant-cell tumors has not been given.

As regards the nature of the growth, certainly some, and possibly all, are neoplastic.

In a large percentage of cases, the lesion should be diagnosed from clinical and roentgenologic data, and should be considered by differential diagnosis in doubtful instances.

For the present, at least, it would seem expedient that these tumors be treated by curettage, followed by thorough electrocoagulation of the tumor-bearing area.

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FAVORABLE TIMES FOR ORTHODONTIC TREATMENT

By Leland R. Johnson, D.D.S., M.S.D., Chicago, Ill.

A REVIEW of the literature on favorable times for orthodontic treatment reveals a general agreement among orthodontists that early treatment of malocclusion is considered good practice. The majority agree that malocclusion in the deciduous dentition and in mixed dentitions (those in which both deciduous and permanent teeth are present) may be successfully treated and with favorable prognosis. It is generally conceded that the type of malocclusion found in the permanent dentition may occur in the deciduous dentition and that treatment in either instance is based on the same fundamentals.

In spite of the weight of opinion in favor of treatment of malocclusion in the deciduous dentition, there are still a few men who question its advisability, and some go so far as to say that rarely should it be undertaken. These opinions revert back to the time when the general concept was that malocclusion should be treated only in the permanent dentition.

Since 1925, much attention has been given the subject of early treatment. In discussing a paper on "Early Treatment of Malocclusion" by J. Lowe Young, in 1925, A. H. Suggett says, "Our whole philosophy has changed from tooth movement to one of development." This statement seems to describe the transition from a concentration of thought on mechanical treatment to a deeper appreciation of the problem of growth and development. Charles R. Baker has been the outstanding advocate of treatment of malocclusion in the deciduous denture, and since 1925 the literature has contained numerous articles of unusual merit written by him on this subject.

Baker, in a paper on "Indications for the Treatment of Malocclusion," divides growth and development of occlusion into five periods. These periods he considers as being most favorable for treatment of malocclusion. The first period, from birth to 3 years, covers the development of the deciduous occlusion. At the end of this period, all the deciduous teeth are in position and the roots are fully developed. The second period, from 3 to 6 years, he considers an advantageous time to correct arch form and those cases in which jaw relation is involved. This opinion is based on the fact that resorption of the roots of the deciduous incisors does not begin until approximately 4 years and 6 months of age. The third period, from 6 to 8 years, is a very important period, for, during that time, the first permanent molars erupt and the deciduous incisors are exchanged for the permanent incisors. The fourth period, from 9 to 11 years, includes the transitional period in which the deciduous molars are exchanged for the premolars. The fifth period, after 12 years, embraces the remaining period of development of the occlusion, which is marked by eruption of the cuspids, second molars and third molars. Although Baker has divided the development of the occlusion into these five periods as being favorable for orthodontic treatment, and it is

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scarcely necessary to again present arguments to support these facts, in an article published in 1933, "Time for Corrective Orthodontic Treatment," he acknowledges the impossibility of laying down definite rules for time of treatment because of the variation in individual cases.

Although the use of chronologic age for the purpose of description is important in an attempt to divide the development of occlusion into periods, in actual treatment of malocclusion, as well as in the supervision and guidance of a developing occlusion, physiologic age is the important age. To diagnose malocclusion adequately, all procedures which may afford information in regard to the physiologic age of a patient must be a part of the routine of examination. T. Wingate Todd's recently published work, "Atlas of Skeletal Maturation," which contains reproductions of forty x-ray plates of the hand of the white male and thirty-five x-ray plates of the hand of the white female set up as standards of maturity, may be of some aid in determining the physiologic age of a child. To each of these plates has been assigned a corresponding chronologic age. That these standards are practical in determining physiologic age can be said only after ample time has been allowed for fair trial of the method.

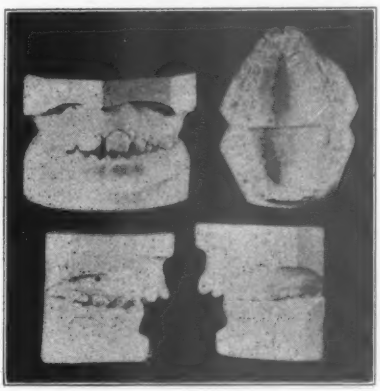

Fig. 1.—Occlusion of girl aged 9 years and 7 months needing additional width in deciduous molar region.

Striking differences between chronologic age and physiologic age are often observed. These variations may be in either direction from the chronologic age. Intelligent assessment of this fact is vital in the diagnosis of malocclusion and many times is the determining factor in deciding whether treatment should be begun immediately or be postponed until conditions are more favorable.

In a case of malocclusion which requires expansion of the arches between the deciduous molars and in which the chronologic age is 9 years, treatment will probably have to be postponed until the premolars begin to erupt, provided the physiologic age corresponds to the chronologic age. However, if, on investigation, it is found that the physiologic age is in fact only 7 years, treatment would be indicated. In the first instance, the roots of the deciduous molars would be so far resorbed that it would be impossible to transmit the necessary growth stimulation to the bone. In the second instance, there would probably be little, if any, resorption of these roots and there would be ample time to obtain the growth required. Figure 1 shows the occlusion of a girl aged 9 years and 7 months needing additional width in the deciduous molar region. The full mouth x-ray examination (Fig. 2) shows that resorption of the roots of the deciduous molars has not begun. The physiologic age of this patient is approximately 7 years and treatment is indicated. In contrast to this case, Figure 3 shows the x-ray films in the case of a girl aged 9 years and 3 months. The roots of the deciduous molars are too far resorbed to be of any value in orthodontic treatment. Treatment of this case should be postponed until the premolars begin to erupt. The physiologic age in this case is slightly in advance of the chronologic age. Treat-

ment is indicated seven months later, at 9 years and 10 months of age. (Fig. 4.)

Figure 5 shows the malocclusion of a girl aged 9 years and 2 months in which all of the premolars are in the process of eruption. Figure 6 shows the x-ray films of the case. This patient has a physiologic age of approximately 11 years. There is no question involved as to time of treatment. All will agree that immediate treatment is indicated.

These three cases do show, however, the wide individual variation in the relation of chronologic age to physiologic age and demonstrate the pitfalls ever present.

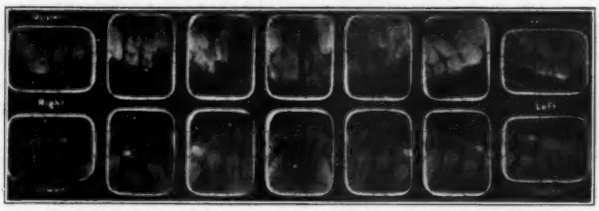

Fig. 2.—Case shown in Figure 1. No resorption of the deciduous roots has occurred. The physiologic age is approximately 7 years.

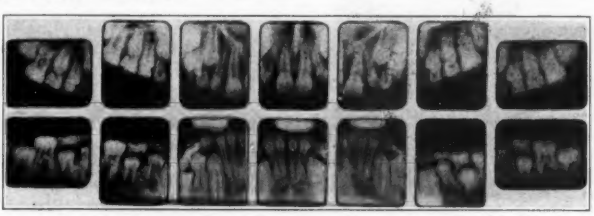

Fig. 3.—Case of girl aged 9 years and 3 months. The physiologic age is slightly in advance of the chronologic age.

Figure 7 shows the occlusion of a boy whose chronologic age is 8 years. Examination of the occlusion reveals that all of the deciduous incisors are still in place, adequate developmental spaces are in evidence and the first permanent molars are unerupted. The arch form is satisfactory and the jaw relation is normal. The full mouth x-ray examination (Fig. 8.) discloses only slight resorption of the mandibular deciduous central incisor roots. These fácts indicate that the physiologic age of this patient, at least as far as the development of the occlusion is concerned, is approximately 5 years. His weight corresponds to his height, although he is not so tall as the average 8-year-old boy. However, his parents are of small stature. Interference of any nature is certainly not indicated in this case. It is simply a case of retarded development and should be handled as any normal case in a 5-year-old child should be. Plaster casts of the occlusion should be made and the case placed under observation.

One year later, at 9 years and 1 month (Fig. 9), it may be noted that the mandibular left first permanent molar is well erupted. The mandibular right first permanent molar and the maxillary left first permanent molar show the outline of only one cusp, while the maxillary right first permanent molar has not yet begun to erupt into the mouth. The mandibular central incisors have erupted and the mandibular deciduous left lateral incisor has been shed. Clinical examination shows no other change. In fact, the casts of either mandible or maxillae made

at 9 years will occlude with those made at 8 years. The x-ray examination (Fig. 10) revealed resorption of the maxillary deciduous central incisors and of the mandibular right deciduous lateral incisor. The progress in development is that which may be expected at the age of 6 years. The physiologic age is still three years behind the chronologic age of 9 years. An x-ray examination (Fig. 11) in the deciduous molar areas, the result of neglected caries. The models (Fig. 13) now show malocclusion for the first time. The maxillary central incisors are widely spaced and in torsiversion. The maxillary left lateral incisor is in torsiversion, and more space must be provided for the maxillary lateral incisors. The maxillary right first permanent molar shows the outline of only one cusp through the tissue. The mandibular right

Fig. 4.—Occlusion of case shown in Figure 3. Orthodontic treatment is now indicated.

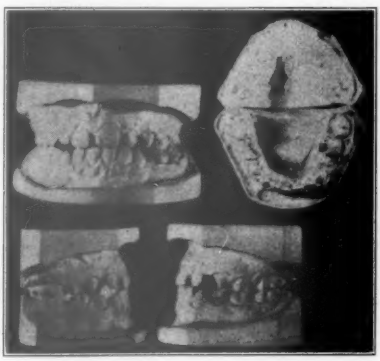

Fig. 5.—Occlusion of a girl aged 9 years and 2 months.

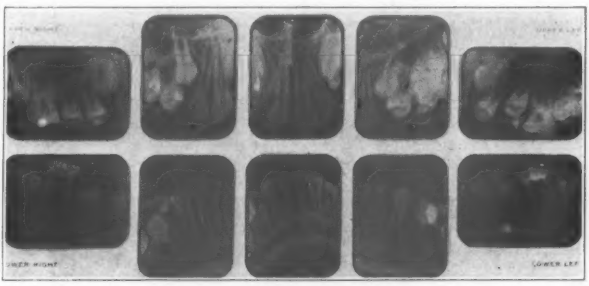

Fig. 6.—Case shown in Figure 5. The x-ray examination revealed the physiologic age to be approximately 11 years.

six months later revealed continued progress, but no lessening of the interval between the chronologic and physiologic ages.

At the chronologic age of 10 years and 6 months, an x-ray examination (Fig. 12) revealed no resorption of the deciduous roots, although it revealed infection

lateral incisor will no doubt be carried into its normal position by the normal function of the tongue without the aid of an orthodontic appliance.

Orthodontic treatment in this case is now indicated and should consist in closing the space between the maxillary central incisors and, if necessary, guiding

the maxillary lateral incisors into position. An anchorage problem, due to the slow eruption of the maxillary first permanent molar and the infected deciduous second molar, is presented, but will not be discussed in this paper.

Figure 14 shows the left side of the occlusion of a boy whose chronologic age is 9 years and 5½ months. The conditions shown in this view are those we can expect to find in many cases of malocclusion. Premature loss of the mandibular deciduous molars has permitted the first permanent molar to move and tip mesially. The maxillary deciduous second molar is still in place and the first bicuspid is well erupted. The left maxillary lateral incisor seems a trifle slow in eruption.

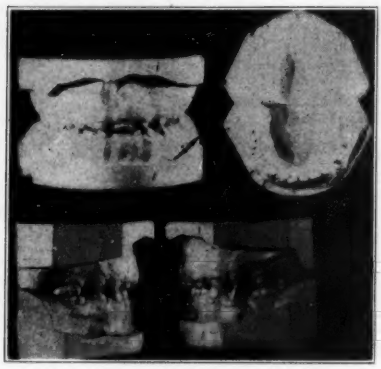

Fig. 7.—Occlusion of boy whose chronologic age is 8 years.

Figure 15 shows the occlusion on the right side. The window in the model shows the roots of all of the maxillary deciduous teeth to be full length. The physiologic age on this side is 5 years, a difference of about four and one-half years from the chronologic age and the development of the opposite side. Attention is also called to the deciduous supernumerary tooth between the maxillary central and lateral incisors, also to the supernumerary tooth which is unerupted. Figure 16 shows the front view and Figure 17 the occlusal.

Fig. 9.—Case shown in Figure 7, one year later.

Fig. 8.—Case shown in Figure 7. The x-ray examination shows the physiologic age to be approximately 5 years.

Figure 18 shows the full mouth x-ray films of this case. With the exception of the region mesially from the right max-

illary deciduous second molar, the development seems to be approximately normal for the age. Treatment of this case consisted of the removal of the unerupted supernumerary tooth and extraction of all the maxillary deciduous teeth from the midline to and including the right deciduous first molar. In order to hasten, if possible, the development of the right side, some of the process covering the central and lateral incisors and the cuspid was removed during the operation. Any orthodontic treatment should be postponed in this instance until some of the permanent teeth erupt on the right side. Space maintainers were placed on both maxillary and mandibular arches, as shown in Figure 19, and the case was placed under observation.

Baker has used in his classification of favorable times for orthodontic treatment periods in which definite stages of development of the dentitions are quite marked. This classification should not be discarded, for it offers a means of grouping the important milestones of the

Fig. 10.—Occlusion shown in Figure 9; development during six years.

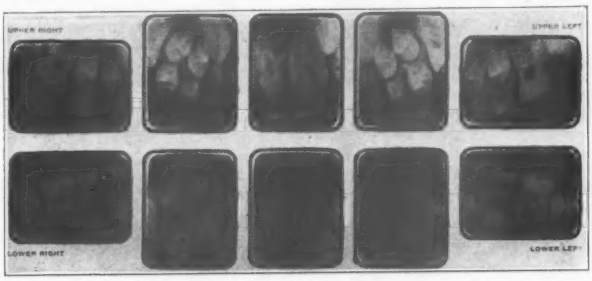

Fig. 11.—Case shown in Figure 9. There has been no lessening of the interval between the chronologic and the physiologic age.

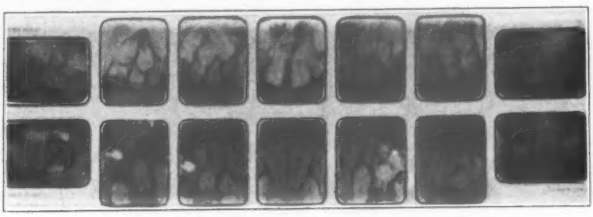

Fig. 12.—Case shown in Figure 11, one year later.

development of the occlusion in the mind of the operator, both in diagnosis and in treatment. However, the cases just discussed indicate that age must be considered as physiologic and not chronologic. Not only is there variation in development of individuals of the same sex, but there is also a difference between the maturity of the male and that of the female. This point is brought out by Todd in his work on maturation of the skeleton. He says:

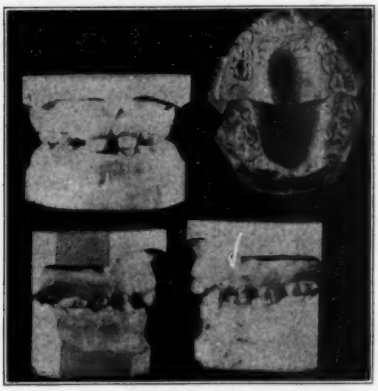

Fig. 13.—Case shown in Figure 7. Malocclusion is now evident.

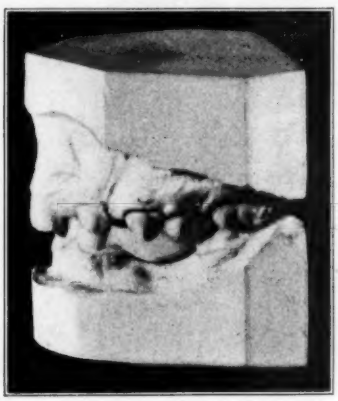

Fig. 14.—Left side of occlusion of boy whose chronologic age is 9 years and 5½ months.

The advancement of the female over the male in skeletal maturity is therefore closely related to the progress of sexual maturation. Until the ninth year the difference between the sexes is negligible; it is only in the thirteenth year that the difference becomes striking. From this date on until the later teens the female is well advanced in maturity over the male, but in the later teens this superiority is no longer registrable in the skeleton and differences between particular children, male and female, may not be evident at all because of the diversity in progress of sexual maturation. This is particularly true of children in whom a long continued constitutional handicap ultimately ends in death.

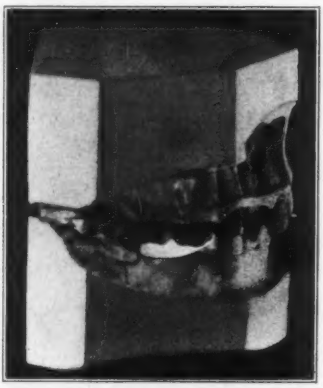

Fig. 15.—Right side showing physiologic age of 5 years. (Case shown in Figure 14.)

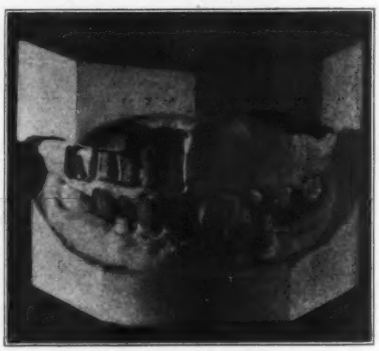

Fig. 16.—Front view of case shown in Figure 14.

The determination of physiologic age means that one must possess a knowledge of growth and development of the jaws and associated structures and of the development of the occlusion. Our present knowledge of growth and development is somewhat limited, and the years ahead will no doubt be filled with revelations which may simplify some of our problems. Information is gradually being added, but if we use that which is already known of this subject, its successful application will mean much in our treatment of malocclusion.

Diagnosis and case analysis presuppose a knowledge of the normal. Ability to recognize the normal makes it possible to recognize the abnormal. There are some who will say that the concept of the normal is an abstraction and that no fixed pattern of development exists. This opinion must be based upon the fact that so much deviation is observed in different individuals, but the fact that the existence of individual variation or deviation is admitted implies that there is a general pattern of development. The fact that a pattern does exist is upheld by Todd when he says,

> That the body possesses a definite growth pattern and does not merely increase in its dimensions like an expanding sphere is of course quite well understood. Vertical growth is relatively great in the limbs during the

Fig. 17.—Occlusal view of case shown in Figure 14.

Fig. 19.—Space maintainers used in case shown in Figure 14.

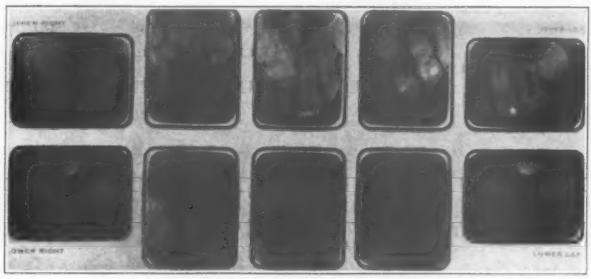

Fig. 18.—Case shown in Figure 14.

grade school period and in the trunk during adolescence. Cranial growth is far greater in infancy than in childhood and practically ceases as a measurable quantity by six years. Vertical growth is quite marked in the upper face during the pre-school age and in the mandible at puberty. The olfactory part of the nose has almost reached adult dimensions at six months of age and the internal ear is adult size at birth. These asymmetries in growth imply adjustment and change of proportion.

Every orthodontist has a mental picture of normal development that he unconsciously uses to measure the abnormal. The ability to recognize the normal and abnormal is gained only by intelligent effort. This means that the orthodontist, to render honest intelligent judgment in the practice of orthodontia, must have a thorough training in and a working knowledge of the anatomy of the head and neck, dental anatomy, biology, embryology, physiology, physics, mechanics and art, as related to orthodontia. Continued study in these subjects is necessary, and the orthodontist must always remain a student to successfully meet his obligation to humanity. Short courses, study clubs, etc., cannot give one this preparation. Whether an orthodontist or a general practitioner, the man who is practicing orthodontia should be adequately prepared to deliver the service he represents himself as able to perform.

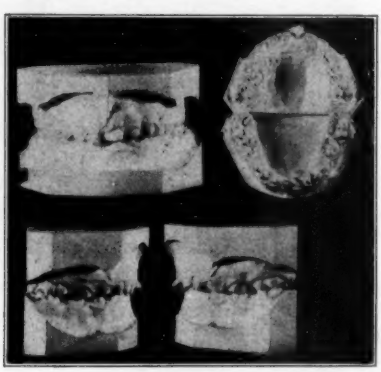

Fig. 20.—Occlusion of girl aged 7 years and 7 months. Extraction of the deciduous incisors is indicated to remove points of interference.

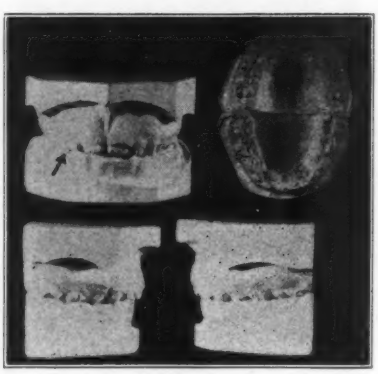

Fig. 21.—Point of interference existing between right cuspids, etiologic factor in potential case of distoclusion.

The early treatment of malocclusion calls for much keener judgment than is required for treatment of malocclusion of the permanent dentition. In early treatment, severe malocclusion must be anticipated and recognized in its simplest form. It is generally accepted that malocclusion should be treated as soon as it becomes evident and that in treatment the object is to bring the occlusion to that state of development which is considered normal for the individual. Now that should mean more than the arrangement of the teeth in such a manner that when the patient places the teeth in centric relation, the occlusion looks to be satisfactory. It means that normal function must exist. The only test for determining the true extent of a malocclusion or the time when treatment of malocclusion is completed is the observation of that occlusion in function.

It has been said of some general practitioners of dentistry that they are interested only in the restorative work to be

done in the mouth and in a mouth examination make no observations of the teeth in occlusion. It can also be said of some orthodontists that their examinations are made with the teeth in occlusion, without any functional observations. In a paper entitled "The Need for a Course in Oral Physiology; Objectives and Content of a Course in Oral Physiology," David W. McLean says,

> Today it is realized that normal development of the face and dentures requires nutritional elements, endocrine control of utilization, a normal balance of environmental pressures, and the stimulus of normal function. Let any one of the factors fail, and malocclusion results. The orthodontist is then called in, to serve as pinch hitter for providence. Not merely to push and pull teeth about, but to be the guiding genius of the child's facial and oral development. The

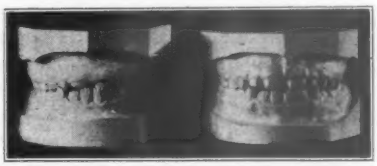

Fig. 22.—Malocclusion corrected in three weeks by means of velum rubber exerciser.

orthodontist tries, therefore, not only to evaluate and remove etiologic factors of the malocclusion, but in addition, to so stimulate growth as to alter or, if you will, to make anatomy that will be the basis for normal physiology of the parts. So orthodontics, too, is advancing from esthetics based upon gnathostatics to esthetics based upon gnathodynamics and is finding that, after all, the most beautiful biologic entities are those oriented and proportioned to fully perform their functions.

Early treatment of malocclusion is closely related to prevention of malocclusion. In fact, it can be considered as a part of prevention of malocclusion. It also follows that the early treatment of malocclusion does not necessarily mean treatment by means of appliances which move teeth. It is just as important to advise extraction of a deciduous tooth at the correct time as it is to move a tooth with an appliance. Figure 20 shows the occlusion of a girl aged 7 years and 7 months. The mandible in its relation to the maxillae shows a tendency toward distoclusion. The overbite is deep and the maxillary deciduous lateral incisors and right central incisor are furnishing points of interference which are guiding the mandible into this distal relation. The pterygoid muscles are very sensitive and will respond to a point of interference even as slight as this appears to be. The child permits the mandible to function where it is most comfortable, and in this case it is more comfortable to function in a slightly distal relationship than

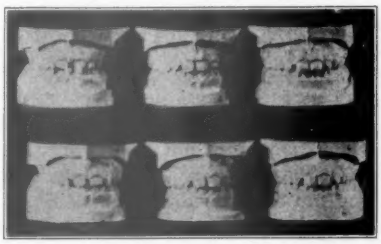

Fig. 23.—Occlusions of identical twins. Models 1, 2 and 3 are those of the treated case. Models 4, 5 and 6 are those of the untreated case.

it is to tolerate the traumatic occlusion in the incisor region. The treatment indicated here is extraction of all the remaining deciduous incisors plus myofunctional therapy. The pterygoid muscle exercise and the masseter and temporal muscle exercise should be advised as soon as the deciduous teeth have been extracted. The case must then be kept under observation and guided to a normal functioning occlusion.

The apparently sensitive response of the pterygoid muscles is responsible for many cases of distoclusion. If the etiologic factor is eliminated early enough,

malocclusion can be intercepted. Figure 21 shows the occlusion of a girl aged 7 years and 6 months. This case shows a tendency toward a distoclusion on the left side. If nothing is done, the case will probably end in a Class II subdivision (Angle) malocclusion. Rogers has said that in this type of case, one should look for the point of interference on the side opposite the distoclusion. Study of this case discloses that the point of interference is the occlusion of the right deciduous cuspids. The treatment indicated is to eliminate this interference by grinding the deciduous cuspids. Exercise of the pterygoid and masseter and temporal muscles is then indicated.

It is essential that a word of caution be interjected at this point. In advising the exercise for the masseter-temporal group of muscles, a position of mechanical advantage must exist. If this does not exist, much harm can be done. If the inclined planes of the teeth are not in a position of mechanical advantage or if the patient does not place the mandible in that position before contraction of the muscles, the development of the malocclusion will be assisted instead of prevented.

A type of malocclusion seen very frequently and which is easily prevented is shown in Figure 22. The maxillary left central incisor is already locked lingually to the mandibular incisors and the maxillary right central incisor soon will be. An exerciser of velum rubber designed by Vernon G. Fisk, of Toronto, was used to correct this case. The child was instructed to bite on the exerciser in such a manner as to exert a labial pressure on the maxillary central incisors. By exerting a downward pressure of the handle of the exerciser, a pry was added which aided in the labial movement of the incisors. In three weeks, the case was corrected, although the model to the right was not made until two months later. The space between the maxillary central incisors is still present, but the *fraenum labii superioris* does not extend between them. Treatment of this condition is not indicated at this time. The space may close when the maxillary lateral incisors erupt. If it does not, treatment can be applied at that time.

The case shown in Figure 23 is a similar case in one of a pair of identical twins. This case is of special interest because one twin served as the control. The upper row of casts are those of the boy with the malocclusion, the lower row those of his twin brother. Model No. 1 shows the malocclusion which was corrected by an appliance. The maxillary central incisors were moved labially and together and retained. In model No. 5, the space between the central incisors is closing. A comparison of models 3 and 6 shows a striking similarity of the two occlusions. The spacing of the incisors is due to a lip-biting habit which developed in both boys during the year before models 3 and 6 were made. It is interesting to note that the lip habits are identical. In spite of the lip habit, the maxillary central incisors of the control (model No. 6) have moved together as well as those which were moved together (model No. 3) by means of an appliance. The closing of the space between the maxillary central incisors seems to indicate that judgment is necessary when a similar space exists, to avoid an unnecessary period of treatment. It must also be remembered that all similar spaces do not close without help. The comparison of the twin boys also presents evidence of the manner in which Nature will continue the development of the pattern when given the opportunity.

The use of space maintainers is one of the important preventive procedures. Judgment must be used to so design them that they will not interfere with function and normal growth will not be inhibited. Whenever possible, they should be made functional in character. The purpose of

space maintainers is more than their name implies. The maintenance of the space is only a part of their usefulness. Many excellent papers have been written on this subject, but time permits only the mention of the value of the space maintainer in the prevention of malocclusion.

Proper dental restorations in the deciduous as well as permanent dentitions must not be overlooked. Although their placement is out of the orthodontic field, it is necessary for the orthodontist to watch constantly for caries and make it his responsibility to see that proper restorations are made.

Habits which may be etiologic factors in a malocclusion must be eliminated. Many cases of malocclusion may be prevented by timely attention to correcting a habit. Parents generally are not aware of the fact that certain habits may cause malocclusion. The possible exception to this statement might be the habit of thumb-sucking. Much publicity has been given the effects of this habit, but even so, some men give parents a false security by saying that if the habit is broken before the third or fourth year, there will be no bad effect. There will be no bad effect from thumb-sucking only if normal function exists after the habit is broken; otherwise, the malocclusion probably will persist. But what of the other habits that cause malocclusion, such as lip-biting, tongue-habits, pillowing and posture habits? Few parents know of the effects of these. Usually, when you tell a mother that her child bites its lip, she is surprised and admits that she has not noticed it. These are the habits that cause malocclusion, but there are other habits equally important, and these are the functional habits.

Functional habits are the useful or helpful habits, the habits of normal function. Bone is a plastic material and its form is altered by the demands made on it. The pressure developed from muscle pull is necessary for the development of the normal jaw. The orthodontist is vitally interested in the perfection of the functional movements of mastication, deglutition and respiration, speech and tongue and lip function, not only in the treatment of malocclusion, but also in the prevention of malocclusion and in the development of functional occlusion.

This paper has mentioned many subjects under the title "Favorable Times for Orthodontic Treatment." It seems impossible to divorce these subjects from this title. The word "treatment" is the stumbling block over which the profession has been falling for many years. The association of treatment with the use of appliances which move teeth has existed for so long that it is difficult to visualize the broader concept of treatment, which includes prevention as well as correction.

The problem of focal infection is one to which dentistry has given much thought. This problem can be solved only through prevention. Dentistry for children is an excellent ground on which to wage the battle against pulpless teeth. Much good can be accomplished here, but not until the etiology of caries has been discovered and means have been provided to eliminate it will the problem be really solved. Even then, it cannot be entirely eliminated; for there will always be present accidents and cases of neglect, in spite of all the preventive work that can be done.

The problem in orthodontia is the same and the only logical way to attack it is through prevention. There will always be malocclusion which must be corrected, and this demands that continued effort to improve methods and procedures must not diminish. Prevention offers a distinct challenge to the orthodontic specialty and that challenge must be accepted.

The next step in this direction and one that needs immediate attention is education; education of the dentist and education of the public. Men in the fields of

dentistry for children and orthodontia have been especially trained in the prevention of malocclusion. There are also some men in general practice who have given this subject enough thought and attention to qualify them. There are many men, and honesty demands frankness, who are not qualified to carry on this work intelligently. These men should be interested enough to apply themselves to study and prepare to carry on in this field. There is one thing certain: Continuous study, observation and research are necessary to develop diagnostic judgment. That which is now known of development must be taken advantage of, but that which is actually known is very little when compared to the vast unknown.

The dental schools must give more attention to oral physiology. The future dentist must be adequately trained to cope with the problem. At present, there is no course dealing specifically with this subject. Each department devotes a certain amount of time to prevention, but the student needs organized instruction in this subject. In a course such as that suggested, direct application to every field of dentistry is necessary.

The orthodontist is sadly handicapped in the field of prevention because seldom does he see the patient until something has gone wrong in development and malocclusion is already present. Few seem to realize that his services could be of value, or perhaps of more value, if he could see the case before malocclusion is so evident. How, then, is it possible to see children in time to guide them to a normal functioning occlusion? The answer is education of the parents; for it is the parent only whose interest in the child is great enough to create the desire for perfection. Until this is done, the work of the orthodontist will consist mainly in the correction of malocclusion which already exists. May we as orthodontists continue to learn by study and observation and thereby develop a keener sense of appreciation of the development of functional occlusion, so that, when the opportunity does arise, we shall be prepared to act with sound judgment.

CONCLUSIONS

1. It is generally agreed that the early treatment of malocclusion is good practice and the condition should be treated as soon as it becomes evident.

2. A knowledge of the normal is essential to recognize the abnormal.

3. Physiologic age is more important than chronologic age in the treatment of malocclusion.

4. An appraisal of occlusion or malocclusion should be an appraisal of function.

5. A broader concept of "treatment" includes all efforts to guide development toward a normal functioning occlusion.

6. The most favorable time for orthodontic treatment arises whenever it becomes necessary to maintain or to restore normal masticatory function.

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STUDIES ON DENTAL CARIES. VIII. RELATIVE INCIDENCE OF CARIES IN THE DIFFERENT PERMANENT TEETH*

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A NUMBER of theories have been proposed in an attempt to determine the etiology of dental caries. These theories have been limited in scope and in application by the difficulty of accounting for each of the many and varied characteristics of the disease. Among these characteristics, one which is outstanding concerns the fact that not only may certain *individuals* be classed as relatively susceptible or immune to the disease, but, in turn, certain *teeth* may be classed as susceptible or immune. In this specific connection, clinical experience indicates that, in general, the lower anterior teeth are relatively resistant to caries, whereas, at the other extreme, the molars are relatively caries susceptible. Thus, wide differences in respect to susceptibility to attack by caries appear to exist in different morphologic types of teeth, just as wide differences in susceptibility to attack by other disease entities are known to exist in different races and different individuals. A detailed analysis of the relative incidence of caries in different morphologic types of teeth, therefore, would appear indicated as a basic approach to an understanding of the pattern which characterizes the attack on the several kinds of teeth by the carious process.

MATERIAL AND METHOD

The analysis to be presented is concerned with the caries rates for grade-school children of Hagerstown, Md., an urban community in the eastern section of the United States. In the spring of 1937, complete dental examinations were made of 4,416 white children, or 94 per cent of the enrolled elementary school population of this community. The examinations were made with No. 3 plain mirrors and fine-pointed pig-tail explorers under favorable lighting conditions. Observations were made on all teeth present in the mouths and, in addition, unerupted and extracted permanent teeth were noted. Pits and fissures in which the explorer caught and which after thorough inspection were not considered definitely carious were noted as separate items and were not counted as carious. Records of fillings and full crowns were made. Teeth designated as carious showed actual carious cavities, fillings or crowns, or were missing (extracted). The number of teeth decayed, missing or filled constitutes the total caries experience.

A measurement of the complete caries experience is readily obtained for the permanent teeth since missing permanent teeth in children may be considered, at least for purposes of the present discussion, the result of caries. An equivalent measurement of the complete caries experience in the deciduous teeth is not possible in the data collected, since a definite decision may not be made as to whether a missing deciduous tooth has or has not been carious. Furthermore, since

*From Child Hygiene Investigations, Division of Public Health Methods, National Institute of Health, U. S. Public Health Service.

TABLE 1.—NUMBER OF SPECIFIED KINDS OF PERMANENT TEETH DMF (DECAYED, MISSING OR FILLED) PER HUNDRED CHILDREN (4,416 CHILDREN, HAGERSTOWN, MD.)

Age	6	7	8	9	10	11	12	13	14	15
Boys										
No. of cases	171	197	231	253	270	262	299	267	199	83
Upper										
Central incisor	....	....	1.7	8.3	9.3	17.6	24.4	25.1	47.2	45.8
Lateral incisor	....	....	0.9	4.7	7.4	16.0	21.1	24.3	38.7	39.8
Cuspid	....	....	.....	0.8	.....	.....	1.0	1.1	4.5	7.2
First bicuspid	....	0.5	0.9	1.2	4.4	6.5	9.4	9.4	21.6	25.3
Second bicuspid	....	....	.....	1.2	4.1	5.7	11.4	9.7	21.1	26.5
First molar	9.4	19.3	41.1	63.6	87.4	88.2	107.4	117.6	116.1	147.0
Second molar	....	....	.....	.....	.....	3.1	9.0	13.5	30.2	48.2
Total	9.4	19.8	44.6	79.8	112.6	137.0	183.6	200.8	279.4	339.8
Lower										
Central incisor	....	....	.....	0.4	3.3	0.8	3.3	5.2	5.5	9.6
Lateral incisor	....	....	.....	0.4	1.9	1.2	3.7	4.1	3.5	12.1
Cuspid	....	....	.....	.....	0.4	.....	0.3	.....	.....	1.2
First bicuspid	....	....	.....	0.4	1.1	2.3	1.7	4.5	1.0	4.8
Second bicuspid	....	....	0.9	0.8	4.4	5.3	6.7	7.9	10.6	24.1
First molar	15.8	38.6	64.9	96.8	114.8	125.2	135.8	135.6	149.3	178.3
Second molar	....	....	.....	.....	0.7	3.8	22.1	40.8	59.3	97.6
Total	15.8	38.6	65.8	98.8	126.7	138.6	173.6	198.1	229.2	327.7
Grand total	25.2	58.4	110.4	178.7	239.3	275.6	357.2	398.9	508.5	667.5
Girls										
No. of cases	156	206	256	240	259	269	297	278	165	58
Upper										
Central incisor	....	....	1.2	10.8	13.5	17.8	32.3	35.3	48.5	58.6
Lateral incisor	0.6	....	0.8	10.4	11.2	20.1	28.0	34.5	35.2	37.9
Cuspid	....	....	.....	0.4	0.4	.....	.....	4.3	1.8	3.5
First bicuspid	....	....	0.4	4.2	4.6	7.1	11.1	19.4	18.8	25.9
Second bicuspid	....	....	.....	2.5	3.5	6.7	8.4	18.7	21.2	17.2
First molar	7.1	24.3	45.3	74.6	88.4	88.9	99.0	122.3	121.8	125.9
Second molar	....	....	.....	0.4	0.4	3.0	6.1	26.6	26.1	44.8
Total	7.7	24.3	47.7	103.3	122.0	143.5	184.9	261.2	273.3	313.8
Lower										
Central incisor	....	0.5	.....	2.9	1.5	2.2	2.4	4.7	4.9	6.9
Lateral incisor	....	....	.....	2.1	0.4	2.2	2.0	2.9	3.0	6.9
Cuspid	....	....	.....	.....	.....	.....	0.3	0.7	0.6	.....
First bicuspid	....	....	0.4	0.8	1.2	1.1	3.4	3.6	1.2	1.7
Second bicuspid	1.9	0.5	0.8	2.1	5.8	6.3	8.8	13.0	15.2	24.1
First molar	23.7	61.2	79.3	114.2	131.3	126.4	137.7	164.4	167.3	165.5
Second molar	....	....	.....	0.4	1.5	11.2	34.7	57.9	71.5	100.0
Total	25.6	62.1	80.5	122.5	141.7	149.4	189.2	247.1	263.6	305.2
Grand total	33.3	86.4	128.1	225.8	263.7	292.9	374.1	508.3	537.0	619.0

the deciduous and permanent dentitions are made up of two distinct sets of teeth, it is desirable that they be considered separately. In the present analysis, only findings on the incidence of caries in the permanent teeth are considered. Caries rates per hundred children are determined by counting decayed, missing or filled permanent teeth (designated as DMF teeth in previous publications 1-6),

dividing this sum by the number of children and multiplying by 100.

FINDINGS AND ANALYSIS

The distributions by age and sex of the numbers of specified kinds of carious (DMF) permanent teeth per hundred children are given in Table 1. In a previous analysis of these data, it was shown[5] that girls have consistently higher caries rates for each chronologic age than boys. The present analysis indicates that this sex difference in caries rates is also a consistent characteristic of the rates for each morphologic type of tooth. (In a recent publication,[6] it has been shown that the sex differences have their origin in sex differences in tooth years of exposure in the mouth.) Throughout the ten age groups studied, the first molars have the highest caries rates of all teeth. Furthermore, the lower first molars show a consistently and significantly higher caries experience rate than the upper first molars. On the other hand, the rates are consistently lowest for the lower incisor, the lower cupid, the lower first bicuspid and the upper cuspid teeth, and the increase of caries in these teeth with respect to advancing chronologic age proceeds very slowly.

The manner in which the caries experience rates increase directly with chronologic age (Table 1) warrants pointed consideration. The number of carious lower first molars per hundred boys, age 6 years, is 15.8. This rate increases with advancing chronologic age until at age 15 the rate is 178.3. This yearly increase in the rates implies that caries is a cumulative disease. The amount accumulated from year to year, therefore, may be readily calculated. For example, since the number of lower first molars attacked by caries, per hundred boys, is 15.8 at age 6 and 38.6 at age 7, the difference between these two rates, 22.8, represents the number of lower first molars per hundred boys which become carious between ages 6 and 7. This increase in caries experience, which has been termed "the annual increment" in a previous publication,[5] will be referred to in the present discussion since it will be shown that the magnitude of the annual increments varies widely for different teeth. This variation in the size of the increment is a result of variations among the teeth in susceptibility to caries.

In order to identify, quantitatively, the relative contributions made to the total caries experience by the individual types of teeth, the different types of teeth are arranged by decreasing order of their caries rates for each age and sex group (Table 2). A study of this table indicates that the lower first molars and upper first molars consistently maintain, respectively, first and second positions as contributors to the caries experience. The other teeth change their relative positions fairly rapidly with advancing age. The latter change is marked by the tendency of the lower second molars and the upper second molars to rise to third and fourth positions, respectively, once they become contributors to caries experience. On the other hand, with increasing chronologic age, the lower incisors, lower cuspids and lower first bicuspids and upper cuspids move downward to occupy the last five positions. It is of interest to point out also the similarity in relative positions (Table 2) of the different teeth for boys and girls, in spite of the fact that girls have higher caries rates than boys.

The recognition of this shifting of positions relative to the amount of caries contributed by each type makes apparent the shortcomings of attempts to determine the caries susceptibility of individual kinds of teeth from caries rates for a single chronologic age.

Table 3 presents data which give for each age and sex group the percentage contribution of each type of tooth to the total caries experience of each jaw. These data emphasize again that caries experi-

TABLE 2.—ORDER (DECREASING) IN WHICH SPECIFIED KINDS OF PERMANENT TEETH CONTRIBUTE TO TOTAL CARIES EXPERIENCE (4,416 CHILDREN, HAGERSTOWN, MD.)

Age									
6	7	8	9	10	11	12	13	14	15
Boys									
L 1st molar U 1st molar	L 1st molar U 1st molar U 1st bicuspid	L 1st molar U 1st molar U central incisor U lateral incisor U 1st bicuspid L 2nd bicuspid	L 1st molar U 1st molar U central incisor U lateral incisor U 1st bicuspid U 2nd bicuspid L 2nd bicuspid U cuspid L lateral incisor L central incisor L 1st bicuspid	L 1st molar U 1st molar U central incisor U lateral incisor U 1st bicuspid L 2nd bicuspid U 2nd bicuspid L central incisor L lateral incisor L 1st bicuspid L 2nd molar L cuspid U cuspid	L 1st molar U 1st molar U central incisor U lateral incisor U 1st bicuspid U 2nd bicuspid L 2nd bicuspid L 2nd molar U 2nd molar L 1st bicuspid L lateral incisor L central incisor U cuspid L cuspid	L 1st molar U 1st molar U central incisor L 2nd molar U lateral incisor U 2nd bicuspid U 1st bicuspid U 2nd molar L 2nd bicuspid L lateral incisor L central incisor L 1st bicuspid U cuspid L cuspid	L 1st molar U 1st molar L 2nd molar U central incisor U lateral incisor U 2nd molar U 2nd bicuspid U 1st bicuspid L 2nd bicuspid L central incisor L 1st bicuspid L lateral incisor U cuspid L cuspid	L 1st molar U 1st molar L 2nd molar U central incisor U lateral incisor U 2nd molar U 1st bicuspid U 2nd bicuspid L 2nd bicuspid L central incisor U cuspid L lateral incisor L 1st bicuspid L cuspid	L 1st molar U 1st molar L 2nd molar U 2nd molar U central incisor U lateral incisor U 2nd bicuspid U 1st bicuspid L 2nd bicuspid L lateral incisor L central incisor U cuspid L 1st bicuspid L cuspid
Girls									
L 1st molar U 1st molar L 2nd bicuspid U lateral incisor	L 1st molar U 1st molar L 2nd bicuspid L central incisor U lateral incisor	L 1st molar U 1st molar U central incisor U lateral incisor L 2nd bicuspid U 1st bicuspid L 1st bicuspid L central incisor	L 1st molar U 1st molar U central incisor U lateral incisor U 1st bicuspid L central incisor U 2nd bicuspid L 2nd bicuspid L lateral incisor L 1st bicuspid L 2nd molar U 2nd molar U cuspid	L 1st molar U 1st molar U central incisor U lateral incisor L 2nd bicuspid U 1st bicuspid U 2nd bicuspid L 2nd molar L central incisor U 2nd molar L lateral incisor U cuspid	L 1st molar U 1st molar U lateral incisor U central incisor L 2nd molar U 1st bicuspid U 2nd bicuspid L 2nd bicuspid U 2nd molar L central incisor L lateral incisor L 1st bicuspid U cuspid	L 1st molar U 1st molar L 2nd molar U central incisor U lateral incisor L 2nd bicuspid U 2nd bicuspid U 2nd molar L 1st bicuspid L central incisor L lateral incisor L cuspid U cuspid	L 1st molar U 1st molar L 2nd molar U central incisor U lateral incisor U 2nd molar U 1st bicuspid L 2nd bicuspid L central incisor U cuspid L lateral incisor L 1st bicuspid L cuspid	L 1st molar U 1st molar L 2nd molar U central incisor U lateral incisor U 2nd molar U 2nd bicuspid U 1st bicuspid L 2nd bicuspid L central incisor L lateral incisor U cuspid L 1st bicuspid L cuspid	L 1st molar U 1st molar L 2nd molar U central incisor U 2nd molar U lateral incisor U 1st bicuspid L 2nd bicuspid U 2nd bicuspid L central incisor L lateral incisor U cuspid L 1st bicuspid L cuspid

ence is largely confined to the first molars in the younger age groups, but gradually spreads throughout the population of teeth as age increases. Differences in the manner of the spread of caries into the teeth of the upper and lower jaws are made apparent by these data. Although the first molars account for 100 per cent of the carious teeth in each jaw at age 6 for boys, the relative amount this tooth contributes to the total caries in the upper jaw decreases until, at age 15, it accounts for only 43 per cent. In the lower jaw, the proportion of the total caries experience contributed by the first molars decreases slowly from ages 6 to 12, and then

TABLE 3.—PERCENTAGE OF CARIES EXPERIENCE OF EACH JAW CONTRIBUTED BY ITS RESPECTIVE AND SPECIFIED KINDS OF PERMANENT TEETH (4,416 CHILDREN, HAGERSTOWN, MD.)

Age	6	7	8	9	10	11	12	13	14	15
Boys										
No. of cases	171	197	231	253	270	262	299	267	199	83
Upper										
Central incisor	....	....	3.9	10.4	8.2	12.8	13.3	12.5	16.9	13.5
Lateral incisor	....	....	2.0	5.9	6.6	11.7	11.5	12.1	13.9	11.7
Cuspid	....	....	....	1.0	....	....	0.5	0.6	1.6	2.1
First bicuspid	....	2.6	2.0	1.5	3.9	4.7	5.1	4.7	7.7	7.5
Second bicuspid	....	....	....	1.5	3.6	4.2	6.2	4.9	7.6	7.8
First molar	100.0	97.4	92.2	79.7	77.6	64.4	58.5	58.6	41.6	43.3
Second molar	....	....	....	....	....	2.2	4.9	6.7	10.8	14.2
Lower										
Central incisor	....	....	....	0.4	2.6	0.6	1.9	2.6	2.4	2.9
Lateral incisor	....	....	....	0.4	1.5	0.8	2.1	2.1	1.5	3.7
Cuspid	....	....	....	....	0.3	....	0.2	....	....	0.4
First bicuspid	....	....	....	0.4	0.9	1.7	1.0	2.3	0.4	1.5
Second bicuspid	....	....	1.3	0.8	3.5	3.9	3.9	5.0	4.6	7.4
First molar	100.0	100.0	98.7	98.0	90.6	90.4	78.2	68.4	65.1	54.4
Second molar	....	....	....	....	0.6	2.8	12.7	20.6	25.9	29.8
Girls										
No. of cases	156	206	256	240	259	269	297	278	165	58
Upper										
Central incisor	....	....	2.5	10.5	11.1	12.4	17.5	13.5	17.7	18.7
Lateral incisor	8.3	....	1.6	10.1	9.2	14.0	15.1	13.2	12.9	12.1
Cuspid	....	....	....	0.4	0.3	....	....	1.7	0.7	1.1
First bicuspid	....	....	0.8	4.0	3.8	4.9	6.0	7.4	6.9	8.2
Second bicuspid	....	....	....	2.4	2.8	4.7	4.6	7.2	7.8	5.5
First molar	91.7	100.0	95.1	72.2	72.5	61.9	53.6	46.8	44.6	40.1
Second molar	....	....	....	0.4	0.3	2.1	3.3	10.2	9.5	14.3
Lower										
Central incisor	....	0.8	....	2.4	1.1	1.5	1.3	1.9	1.8	2.3
Lateral incisor	....	....	....	1.7	0.3	1.5	1.1	1.2	1.2	2.3
Cuspid	....	....	....	....	....	....	0.2	0.3	0.2	....
First bicuspid	....	....	0.5	0.7	0.8	0.8	1.8	1.5	0.5	0.6
Second bicuspid	7.5	0.8	1.0	1.7	4.1	4.2	4.6	5.2	5.8	7.9
First molar	92.5	98.4	98.6	93.2	92.6	84.6	72.8	66.5	63.5	54.2
Second molar	....	....	....	0.3	1.1	7.5	18.3	23.4	27.1	32.8

decreases rapidly from age 12 through age 15 to 54.4 per cent. These differences in the caries experience in the two jaws may be explained on the basis of the apparently greater resistance to caries of the lower incisor, cuspid and first bicuspid teeth; whereas, in the upper jaw, only the cuspid shows a similar degree of resistance. The inclusion of the lower first bicuspid in this group of caries-resistant

TABLE 4.—PERCENTAGE OF TOTAL CARIES EXPERIENCE CONTRIBUTED BY SPECIFIED KINDS OF PERMANENT TEETH (4,416 CHILDREN, HAGERSTOWN, MD.)

Age	6	7	8	9	10	11	12	13	14	15
Boys										
No. of cases	171	197	231	253	270	262	299	267	199	83
Upper										
Central incisor	....	....	1.6	4.7	3.9	6.4	6.8	6.3	9.3	6.9
Lateral incisor	....	....	0.8	2.7	2.1	5.8	5.9	6.1	7.6	6.0
Cuspid	....	....	....	0.4	....	....	0.3	0.3	0.9	1.1
First bicuspid	....	0.9	0.8	0.7	1.9	2.4	2.6	2.4	4.3	3.8
Second bicuspid	....	....	....	0.7	1.7	2.1	3.2	2.4	4.2	4.0
First molar	37.2	33.0	37.3	35.6	36.5	32.0	30.1	29.5	22.8	22.0
Second molar	....	....	....	....	....	1.1	2.5	3.4	5.9	7.2
Total	37.2	33.9	40.4	44.7	47.1	49.7	51.4	50.3	54.9	50.9
Lower										
Central incisor	....	....	....	0.2	1.4	0.3	0.9	1.3	1.1	1.4
Lateral incisor	....	....	....	0.2	0.8	0.4	1.0	1.0	0.7	1.8
Cuspid	....	....	....	....	0.2	....	0.1	....	....	0.2
First bicuspid	....	....	....	0.2	0.5	0.8	0.5	1.1	0.2	0.7
Second bicuspid	....	....	0.8	0.4	1.9	1.9	1.9	2.0	2.1	3.6
First molar	62.8	66.1	58.8	54.2	48.0	45.4	38.0	34.0	29.4	26.7
Second molar	....	....	....	....	0.3	1.4	6.2	10.2	11.7	14.6
Total	62.8	66.1	59.6	55.3	52.9	50.3	48.6	49.7	45.1	49.1
Girls										
No. of cases	156	206	256	240	259	269	297	278	165	58
Upper										
Central incisor	....	....	0.9	4.8	5.1	6.1	8.6	6.9	9.0	9.5
Lateral incisor	1.9	....	0.6	4.6	4.3	6.9	7.5	6.8	6.6	6.1
Cuspid	....	....	....	0.2	0.2	....	....	0.9	0.3	0.6
First bicuspid	....	....	0.3	1.9	1.8	2.4	3.0	3.8	3.5	4.2
Second bicuspid	....	....	....	1.1	1.3	2.3	2.3	3.7	4.0	2.8
First molar	21.2	28.1	35.4	33.0	33.5	30.3	26.5	24.1	22.7	20.3
Second molar	....	....	....	0.2	0.2	1.0	1.6	5.2	4.9	7.2
Total	23.1	28.1	37.2	45.8	46.3	49.0	49.4	51.4	50.9	50.7
Lower										
Central incisor	....	0.6	....	1.3	0.6	0.8	0.6	0.9	0.9	1.1
Lateral incisor	....	....	....	0.9	0.2	0.8	0.5	0.6	0.6	1.1
Cuspid	....	....	....	....	....	....	0.1	0.1	0.1	....
First bicuspid	....	....	0.3	0.4	0.4	0.4	0.9	0.7	0.2	0.3
Second bicuspid	5.8	0.6	0.6	0.9	2.2	2.2	2.3	2.6	2.8	3.9
First molar	71.2	70.8	61.9	50.6	49.8	43.2	36.8	32.3	31.2	26.7
Second molar	....	....	....	0.2	0.6	3.8	9.3	11.4	13.3	16.2
Total	76.9	71.9	62.8	54.2	53.7	51.0	50.6	48.6	49.1	49.3

teeth is of some interest, since it is a tooth having occlusal pits.

The percentage contributions of each type of tooth to the total caries experience in both jaws together per hundred children for each age and sex are shown in Table 4. With advancing age, there is a gradual increase in the proportion of total caries contributed by each of the upper teeth with the exception of the first molars and cuspids, the first molars contributing a relatively lessening proportion as age increases. With the exception of the lower molars and lower second bicuspids, the other lower teeth maintain a small, more or less stationary,

TABLE 5.—NUMBER OF SPECIFIED KINDS OF PERMANENT TEETH ERUPTED PER HUNDRED CHILDREN (4,416 CHILDREN, HAGERSTOWN, MD.)

Age	6	7	8	9	10	11	12	13	14	15
Boys										
No. of cases	171	197	231	253	270	262	299	267	199	83
Upper										
Central incisor	29.8	108.6	180.1	196.8	200.0	200.0	200.0	200.0	200.0	200.0
Lateral incisor	5.3	30.5	87.0	160.5	191.9	193.5	197.3	198.9	197.5	195.2
Cuspid	.....	1.5	2.6	10.7	31.1	81.7	138.8	181.3	186.4	192.8
First bicuspid	.....	2.5	19.9	54.2	101.1	153.1	181.3	194.8	198.0	200.0
Second bicuspid	0.6	0.5	9.5	32.0	67.0	121.8	160.9	181.7	190.5	195.2
First molar	109.4	177.7	193.9	200.0	200.0	200.0	200.0	200.0	200.0	200.0
Second molar	.....	.....	.....	0.8	5.2	34.0	91.0	146.4	169.4	175.9
Lower										
Central incisor	126.9	182.7	198.7	198.4	199.3	200.0	200.0	199.3	200.0	200.0
Lateral incisor	24.6	91.4	171.4	193.3	197.4	199.6	199.7	199.6	200.0	200.0
Cuspid	1.2	1.0	3.5	24.1	90.0	153.1	182.3	197.0	197.5	200.0
First bicuspid	0.6	.....	5.6	33.2	86.5	145.8	170.2	193.6	196.5	197.6
Second bicuspid	.....	.....	6.1	19.4	59.3	107.6	144.5	168.5	185.4	186.8
First molar	131.0	183.8	197.8	200.0	200.0	199.2	199.7	199.6	199.0	200.0
Second molar	.....	.....	.....	1.6	15.2	64.1	116.1	169.7	175.4	191.6
Girls										
No. of cases	156	206	256	240	259	269	297	278	165	58
Upper										
Central incisor	52.6	140.3	188.3	199.2	199.2	200.0	199.7	200.0	200.0	200.0
Lateral incisor	7.1	44.7	127.0	187.5	188.4	196.3	197.0	197.1	197.6	193.1
Cuspid	2.6	1.5	4.3	17.1	70.3	132.7	169.7	187.4	191.5	196.6
First bicuspid	1.3	4.4	21.1	72.9	125.1	175.1	190.2	197.1	198.8	198.3
Second bicuspid	1.3	2.4	9.0	37.5	89.2	141.6	167.7	188.1	197.0	194.8
First molar	122.4	185.9	199.2	199.2	200.0	200.0	199.7	199.6	200.0	200.0
Second molar	.....	.....	.....	0.8	12.0	51.3	114.8	159.7	183.0	182.8
Lower										
Central incisor	159.6	189.8	198.4	199.2	200.0	200.0	200.0	200.0	200.0	200.0
Lateral incisor	44.9	122.3	185.2	199.2	200.0	200.0	200.0	200.0	200.0	200.0
Cuspid	2.6	2.4	14.8	82.1	140.5	187.7	193.6	199.6	198.8	200.0
First bicuspid	1.3	2.9	11.7	65.0	111.2	172.5	188.6	196.0	198.2	200.0
Second bicuspid	1.9	1.5	8.6	35.0	72.2	132.3	159.3	178.4	195.2	189.7
First molar	153.9	187.4	199.2	200.0	200.0	199.3	200.0	200.0	200.0	200.0
Second molar	.....	.....	.....	3.3	29.0	86.3	141.8	166.9	187.3	193.1

contribution to the total caries experience. The percentage of the caries experience contributed by the lower first molars declines rapidly from 62.8 at age 6 to 26.7 at age 15 in boys, whereas the second bicuspids and second molars show an increase. These characteristic differences in the spread of caries into the teeth of each jaw are reflected in the calculations of the relative proportion (Table 4) of the total caries contributed by each jaw. The decided trend upward from 37.2 per cent at age 6 to 50.9 per cent at age 15 with respect to the upper jaw, and downward from 62.8 per cent to 49.1 per cent in the lower jaw, makes

TABLE 6.—PERCENTAGES OF SPECIFIED KINDS OF ERUPTED PERMANENT TEETH DMF PER HUNDRED CHILDREN (4,416 CHILDREN, HAGERSTOWN, MD.)

Age	6	7	8	9	10	11	12	13	14	15
Boys										
No. of cases	171	197	231	253	270	262	299	267	199	83
Upper										
Central incisor	....	....	1.0	4.2	4.6	8.8	12.2	12.6	23.6	22.9
Lateral incisor	....	....	1.0	3.0	3.9	8.3	10.7	12.2	19.6	20.4
Cuspid	....	....	....	7.4	....	....	0.7	0.6	2.4	3.8
First bicuspid	....	20.1	4.4	2.2	4.4	4.2	5.2	4.8	10.9	12.7
Second bicuspid	....	....	....	3.7	6.1	4.7	7.1	5.4	11.1	13.6
First molar	8.6	10.9	21.2	31.8	43.7	44.1	53.7	58.8	58.0	73.5
Second molar	....	....	....	....	....	9.0	9.9	9.2	17.8	27.4
Lower										
Central incisor	....	....	....	0.2	1.7	0.4	1.7	2.6	2.8	4.8
Lateral incisor	....	....	....	0.2	0.9	0.6	1.8	2.1	1.8	6.0
Cuspid	....	....	....	....	0.4	....	0.2	....	....	0.6
First bicuspid	....	....	....	1.2	1.3	1.6	1.0	2.3	0.5	2.4
Second bicuspid	....	....	14.4	4.1	7.5	5.0	4.6	4.7	5.7	12.9
First molar	12.1	21.0	32.8	48.4	57.4	62.8	68.0	67.9	75.0	89.2
Second molar	....	....	....	....	4.9	6.0	19.0	24.1	33.8	50.9
Girls										
No. of cases	156	206	256	240	259	269	297	278	165	58
Upper										
Central incisor	....	....	0.6	5.4	6.8	8.9	16.2	17.6	24.2	29.3
Lateral incisor	9.1	....	0.6	5.6	5.9	10.2	14.2	17.5	17.8	19.6
Cuspid	....	....	....	2.5	0.6	....	....	2.3	1.0	1.8
First bicuspid	....	....	1.9	5.7	3.7	4.0	5.8	9.9	9.5	13.0
Second bicuspid	....	....	....	6.7	3.9	4.7	5.0	10.0	10.8	8.9
First molar	5.8	13.1	22.7	37.5	44.2	44.4	49.6	61.3	60.9	62.9
Second molar	....	....	....	50.6	3.3	5.8	5.3	16.7	14.2	24.5
Lower										
Central incisor	....	0.3	....	1.5	0.8	1.1	1.2	2.3	2.4	3.5
Lateral incisor	....	....	....	1.0	0.2	1.1	1.0	1.4	1.5	3.5
Cuspid	....	....	....	....	....	....	0.2	0.4	0.3	....
First bicuspid	....	....	3.3	1.3	1.0	0.7	1.8	1.8	0.6	0.9
Second bicuspid	100.0	33.6	9.1	5.9	8.0	4.8	5.5	7.3	7.8	12.7
First molar	15.4	32.6	39.8	57.1	65.6	63.4	68.9	82.2	83.6	82.8
Second molar	....	....	....	12.6	5.3	12.9	24.5	34.7	38.2	51.8

evident one characteristic of the spread of caries into the two jaw segments.

It is evident that age 15 years is that point on the chronologic scale where the number of carious teeth in each of the two jaws is about equal. From age 6 to 15, the proportion of the total caries experience contributed by the upper jaw steadily increases to 50.9 per cent, whereas the proportion contributed by the lower jaw steadily decreases to 49.1 per cent. On the basis of these trends, it may be stated that up to age 15, for both boys and girls, more lower teeth are carious than upper, and it may be postulated that after age 15, more upper teeth are carious than lower. These observations are in agreement with previously published data which reveal that tooth mortality rates are higher for the lower than for the upper permanent teeth in children,[3] but the loss of the full complement of upper teeth precedes the loss of the full complement of lower teeth in adults.[7, 8]

Throughout the foregoing consideration of the relative incidence of caries in different morphologic types of teeth, the findings have been presented on the basis of caries rates per hundred children. However, since the age span from 6 through 15 years covers the period when the deciduous teeth are being replaced by the permanent teeth, it is evident that the number of permanent teeth per hundred children has been changing and increasing rapidly. Recognition of this fact makes it apparent that the number and kinds of teeth attacked by caries are intimately related to the number erupted at particular ages. Table 5 presents, therefore, data[9] which give the number of specified permanent teeth erupted per hundred children for each age-sex group. These data indicate the manner in which the eruption of teeth contributes, at different ages, different numbers and kinds of teeth to the population of teeth present in the mouth.

Since Table 1 presents the number of each type of tooth decayed and Table 5 the number of each type of tooth erupted, per hundred children for each age and sex, the percentages of each type of tooth erupted which are decayed may be readily calculated. These percentages are given in Table 6, and the findings indicate, quantitatively, the incidence of caries in each tooth type in terms of those teeth which have erupted. This method of expressing caries experience affords a means of observing the caries pattern of each tooth type in terms of those teeth which are erupted in the mouth and therefore exposed to the risk of attack by caries.

TABLE 7.—MEAN AND STANDARD DEVIATION OF AGE DISTRIBUTIONS OR ERUPTION OF SPECIFIED KINDS OF PERMANENT TEETH (4,416 CHILDREN, HAGERSTOWN, MD.)

	Boys				Girls			
	Upper		Lower		Upper		Lower	
	Mean (Years)	Standard Deviation (Years)	Mean (Years)	Standard Deviation (Years)	Mean (Years)	Standard Deviation (Years)	Mean (Years)	Standard Deviation (Years)
Central incisor	7.5	0.8	6.5	0.7	7.2	0.8	6.2	0.7
Lateral incisor	8.6	1.1	7.6	0.8	8.2	0.9	7.3	0.8
Cuspid	11.8	1.4	10.7	1.2	11.1	1.4	9.9	1.2
First bicuspid	10.4	1.5	10.8	1.4	10.0	1.4	10.2	1.4
Second bicuspid	11.2	1.7	11.5	1.8	10.8	1.6	11.0	1.7
First molar	6.6	0.8	6.4	0.8	6.5	0.7	6.1	0.9
Second molar	12.7	1.2	12.2	1.2	12.4	1.4	11.9	1.6

By reference to Table 7, which shows the mean age of eruption of the teeth and the standard deviations of their age distributions of eruption, it is indicated that for boys the mean age of eruption of the lower first molars is 6.4 years and of the lower second molars is 12.2 years, a difference of approximately six years. Thus, to compare the percentages of lower first molars carious with those of the lower second molars (in boys), it would appear necessary to adjust for the differences in eruption. This adjustment may be accomplished roughly by comparing the caries percentages of the first molars at ages 6, 7, 8 and 9 with the percentages of the second molars carious at ages 12, 13, 14 and 15. Referring to Table 6, therefore, it may be observed that the caries percentages of the first molars, 12.1, 21.0, 32.8 and 48.4, would, on the basis of the previous remarks, be comparable to the caries percentages of the second molars, 19.0, 24., 33.8 and 50.9.

The results of this procedure indicate that the proportions of lower second molars attacked by caries are only slightly higher than those of the lower first molars, and that the size of the annual increments for each age after the mean ages of eruption are approximately the same. The conclusion is, therefore, that the lower second molars are of about the same order of susceptibility to caries as the lower first molars. A like comparison is readily applied to the upper first and second molars. According to Table 7, the former erupts at a mean age of 6.6 years and the latter at a mean age of 12.7 years, a difference of approximately six years. However, when the percentages of upper first molars attacked by caries (8.6, 10.9, 21.2 and 31.8) are compared with those of the upper second molars (9.9, 9.2, 17.8 and 27.4), it is clearly evident that the former is of the same, or of only a slightly greater, order of susceptibility than the latter type of tooth. In general, therefore, the order of susceptibility to caries of the permanent molars studied may be indicated as: (1) lower first and second molars, (2) upper first and second molars. This order is at variance with that reported by Leigh,[10] who based his findings on caries rates for a single average chronologic age (18 years). This investigator indicated that the lower first molar is significantly more susceptible to caries than the other teeth, and that the upper first molar ranks second in susceptibility.

Although the specific comparison of data on the mean age of eruption with data on caries rates for specified chronologic ages has been presented for the molars alone in order to identify their relative caries susceptibility, the same procedure is readily applied to the other teeth. Since the relative size of the annual increment of caries at the mean age of eruption of each tooth and its rate of accumulation each year thereafter determine roughly the comparative susceptibility of specific teeth to caries, the following general findings are revealed as the result of an interpretation of data contained in Tables 6 and 7: The molars have the highest order of susceptibility; the upper incisors, upper first and second bicuspids and lower second bicuspids have an intermediate order of susceptibility, and, finally, the lower incisors, lower cuspids, lower first bicuspids and upper cuspids have the lowest order of susceptibility.

The details of the individual orders of susceptibility of the teeth made available by the technics described in this paper lead to serious consideration of more exact statistical methods by means of which further elucidation of caries susceptibility may be achieved. In subsequent publications, the individual variations in susceptibiilty of the several permanent teeth to attack by caries will be analyzed on the basis of post-eruptive tooth age,[11] a procedure which takes

completely into account the influence of variations in the time of eruption of the different teeth on their specific caries susceptibility.

SUMMARY

An analysis of the distribution of dental caries in the different morphologic types of teeth, per hundred children for specific age and sex groups, is presented for 4,416 children. The findings are as follows: 1. Girls have a higher incidence of caries in each type of tooth for each chronologic age than boys. 2. In both sexes, the number of carious first molars, for each age, is markedly higher than that of any other tooth, and the number of lower first molars carious is significantly higher than the number of upper first molars. 3. The lower incisors, lower cuspids, lower first bicuspids and upper cuspids are characterized by low caries attack rates. 4. Arranged in the order (decreasing) in which specified kinds of permanent teeth contribute to the total caries experience, specific for age and sex, the lower first molar and upper first molar consistently maintain first and second positions, respectively. The relative positions of the other teeth change fairly rapidly with advancing chronologic age. This change is characterized by a marked tendency for the lower second molars and upper second molars to rise to third and fourth positions, respectively, while the lower incisors, lower cuspid, lower first bicuspid and upper cuspid move downward to the last five positions. 5. A determination of the contributions which each tooth makes to the caries experience of each jaw and to that of both jaws indicates a wide difference in the manner and spread of caries into the respective jaws. In part, this difference is explained on the basis of the marked resistance which the lower incisors, lower cuspids, lower first bicuspids and upper cuspids offer to the spread of caries in the lower jaw; whereas, in the upper jaw, only the cuspid offers a similar degree of resistance. 6. Age 15 represents that age (both sexes) when the number of carious teeth in each jaw is about equal. Up to age 15, more lower teeth are carious than upper, and it is postulated that after age 15, more upper teeth are carious than lower.

Since the mean ages of eruption for the several kinds of teeth vary widely and different numbers and kinds of teeth make up the teeth present at each chronologic age, the mean age of eruption was used as a base line to determine the relative susceptibility of teeth to caries and the following findings are presented: 1. Lower second molars have about the same order of susceptibility to caries as lower first molars. 2. Upper second molars have about the same order of susceptibility as upper first molars. 3. In general, the molars have the highest order of susceptibility; the upper incisors, upper first and second bicuspids and lower second bicuspids have an intermediate order of susceptibility, and, finally, the lower incisors, lower cuspids, lower first bicuspids and upper cuspids have the lowest order of susceptibility to caries.

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BACTERIOLOGIC STUDY OF CARIOUS CAVITIES

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BACTERIOLOGIC studies of dental caries have attributed causative rôles to various micro-organisms. Of these so far unproved bacterial factors, the following may be noted: *Leptothrix buccalis* (Leber and Rottenstein, 1876), four types of bacilli (Vignal and Galippe, 1889), the sarcina, staphylococcus, streptococcus and *Bacillus necrodentalis* (Goadby, 1903), streptococcus (Kantorowicz, 1911; Clarke, 1924), leptothrix, cladothrix and lactobacillus (Kligler, 1915), lactobacillus (McIntosh, James and Lazarus-Barlow, 1928; Bunting *et al.*, 1928 and 1936), fusiformis (Schlirf, 1926) and, finally, "any microbe which can produce an appreciable quantity of acid" (Sequin, 1931; Appleton, 1933). The last view is particularly interesting because it reflects the idea advanced by Miller (1890) when he propounded the chemicoparasitic theory of dental caries.

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Two principal explanations can be offered to account for these divergent opinions. First, different cultural methods have been used and the effects of culture media in favoring particular types of micro-organisms have been ignored. This has also tended to minimize the possible complexity of the bacterial flora of caries. Second, no account has been taken of either differences which may occur between the flora of different cavities or the variations which may occur in the same cavity from day to day.

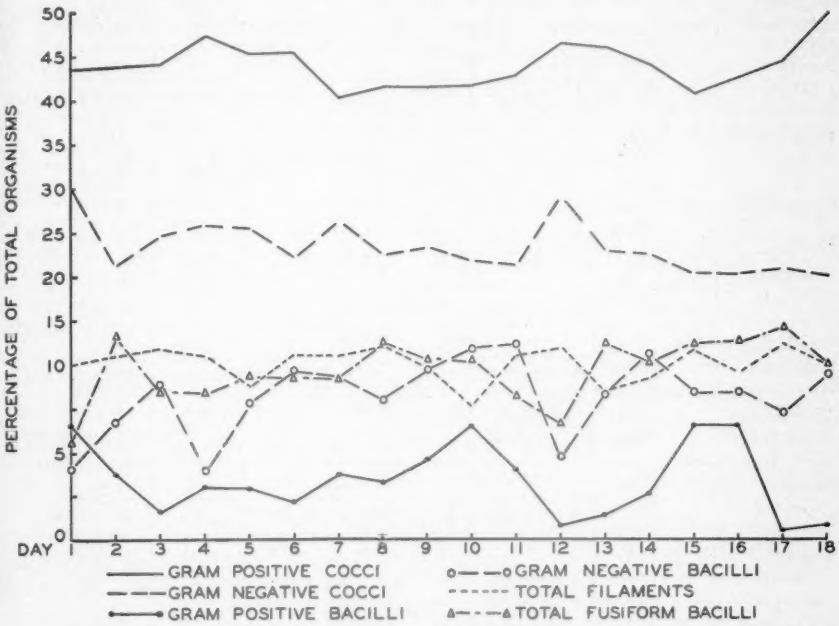
This report presents the results of surveys of cavity flora which attempt by use of direct microscope examinations to include the diversity of organisms present and to estimate approximately their numerical distribution, thus eliminating some of the unsatisfactory features of previous studies.

METHODS AND MATERIALS

To avoid the uncertainties of cultural procedures, estimates of the percentage occurrence of various morphologic groups of micro-organisms were made in gram-stained smears. Details of the procedure and an evaluation of its accuracy have been given elsewhere (Bibby, 1938).

The material for examination was obtained from the teeth of children during operative procedures at the Rochester Dental Dispensary and from freshly extracted adult teeth obtained at the Strong Memorial Hospital. The cavities were classified into various "types" according to their clinical characteristics and such histories as were available. The classifications used allowed the same cavity to be placed in more than one group or type. In all instances, the superficial uniform technic in which superficial débris was removed by a preliminary rinsing of the mouth with physiologic solution of sodium chloride, after which the cavity was dried and isolated by means of cotton rolls.

In these studies, the organisms were divided into gram-positive and gram-negative cocci, gram-positive and gram-negative bacilli, vibriones, filaments and fusiform organisms. Because their reactions to the gram stain are indefinite, the



Percentages of various groups of organisms in repeated smears from carious cavity.

débris was carefully cleaned out of the cavities and discarded. Material from the deeper layers was then taken on dental instruments and transferred directly to the microscope slides. Material for the study of daily variations in the flora of an established cavity was obtained from a small distogingival cavity in a lower bicuspid. Specimens were carefully collected at a fixed time of day with a last three groups were not subdivided by that means. With the bacilli were grouped all individual organisms of less than 15μ in length except those pointed organisms included in the fusiform group.

FINDINGS

The percentage occurrence of different morphologic groups of organisms showed no constancy in any of these series of

estimates. Indeed, the wide ranges of variation were the striking feature in the findings. The accompanying table presents a summary of the percentage occurrence of the various groups of organisms in the different types of cavities. It is apparent that no significant differences appear between the percentages of organisms in the various "types" of caries. The outstanding finding is that in all of them the gram-negative cocci are very numerous and consistently outnumber the gram-positive cocci. The low percentages of gram-positive bacilli, which include lactobacilli, are also worthy of note.

The repeated counts of smears from the same cavity, as shown in the accompanying graph, indicated that although the percentages of different micro-organisms varied markedly from day to day, they generally maintained the same relative order in their occurrence. Thus, the gram-positive cocci predominated throughout the entire period, with percentages ranging from 40 to 51. The gram-negative cocci were next in frequency, varying between 20 and 29 per cent. The percentages of gram-negative

PERCENTAGES OF VARIOUS GROUPS OF MICRO-ORGANISMS IN CARIOUS CAVITIES

Source of Specimen	No. in Series		Percentages of Total Organisms Counted						
			Cocci		Bacilli		Fusiform	Filaments	Vibriones
			Gram +	Gram −	Gram +	Gram −	Gram ±	Gram ±	Gram ±
Superficial caries	9	Av.	32.2	42.5	2.5	9.8	1.6	6.4	5.0
		Range	9.3–40.7	26.2–70.9	0–6.5	0–30.5	0–3.8	0–14.8	0–25.5
Deep caries	35	Av.	33.7	49.3	2.7	5.7	1.1	5.8	1.7
		Range	11.0–50.6	28.2–85.2	0–9.3	1.2–12.8	0–8.4	0.9–12.1	0–10.0
Rapid caries	10	Av.	24.6	60.1	2.3	3.7	0.8	6.5	1.9
		Range	9.3–46.6	40.2–85.2	0–8.2	0–10.6	0–3.0	0.9–14.8	0–10.0
Slow caries	6	Av.	35.1	53.9	1.7	3.9	0.6	4.3	0.5
		Range	23.9–46.1	42.5–68.6	0–5.0	3.2–5.8	0.28	1.8– 9.3	0–1.0
Decalcified dentin	14	Av.	35.2	50.5	2.6	4.2	0.5	5.8	1.1
		Range	18.5–50.6	36.7–75.0	0–8.2	1.3–10.3	0–2.3	1.7–11.2	0–5.1
Deep decalcified dentin	8	Av.	28.5	50.6	3.8	4.9	1.6	5.2	5.4
		Range	11.0–43.5	28.2–85.2	0.6–8.2	1.3–10.0	0–4.1	0.9–12.1	0–25.5
Gingival cavities	3	Av.	23.7	43.3	3.1	18.9	0.9	4.3	5.8
		Range	19.1–31.9	27.0–58.0	1.6–6.1	10.3–30.3	0–2.3	1.2– 7.0	0–12.1
Fissure cavities	2	Av.	44.6	40.4	3.0	4.6	1.1	5.6	0.6
		Range	4.0–49.2	37.7–43.1	1.5–4.5	2.6– 6.6	0–2.3	3.6– 7.7	0–1.2
All cavities in adults	26	Av.	28.5	50.4	3.3	7.0	1.4	6.2	3.2
		Range	9.3–46.12	6.2–85.2	0–8.2	0–30.3	0–4.1	0.4–14.8	0–25.5
All cavities in children	18	Av.	39.7	44.0	2.0	5.8	1.0	5.5	1.9
		Range	25.5–63.0	30.0–58.9	0–9.3	1.2–12.8	0–8.4	0–10.3	0–7.6

bacilli and gram-positive bacilli ranged from 4 to 12 and 0.5 to 6 respectively. The percentages of filaments and fusiform bacilli appeared to vary in relation to one another more than did the other groups. The fusiforms ranged between 7.0 and 14.5 per cent and the filaments between 6.5 and 11.5 per cent, first one group and then the other being more prominent.

COMMENT

The outstanding finding in this work is that extreme differences occur in the flora of carious cavities. Not even in cavities of the same types does there appear to be any constancy. The demonstration of a complex bacterial flora in the depth of all cavities, with no distinct morphologic group predominating, indicates that this location favors no particular group of organisms. It also suggests that no specific bacterial species can be considered the cause of dental caries. This idea is supported by the absence of significant differences between the flora of rapid and those of slow caries. The high percentages of cocci, especially gram-negative, in all cavities suggests the possibility that these organisms are causative agents. The relatively high percentages of gram-negative bacilli, filaments and fusiform organisms as compared with the gram-positive bacilli raised doubt concerning the importance in caries of lactobacilli which are included in the last named group. In the repeated smears, the percentages of all the groups except the fusiform bacilli and filaments remain well separated. Apparently, therefore, as in other sites (Bibby and Hine, 1938), there is some degree of constancy in the flora of a given cavity over short periods of time.

SUMMARY

A total of forty-four smears from different types of carious cavities in forty-two mouths were examined microscopically and the percentages of various groups of micro-organisms in them were estimated by a direct counting method.

The counts showed that variations occur in the flora of different cavities and in the same cavity from day to day.

There was no significant evidence of the primary importance in dental caries of any particular morphologic group of bacteria. On the other hand, the findings demonstrated that a varied and mixed flora exist in established cavities.

No definite differences could be found among the bacterial flora of different "types" of cavities.

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TEMPOROMANDIBULAR REACTIONS TO OCCLUSAL ANOMALIES

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THE unprecedented interest that has been aroused recently in the temporomandibular joint has led to an earnest but confused attempt to assign to this long neglected anatomic entity its rightful responsibility in regard to a variety of vaguely explained symptoms.

With the realization that many disturbances of the temporomandibular joint are associated basically with anomalies of occlusion, I am urging the various branches of dentistry to accept their responsibility in this matter as a duty to our patients.

One of the more important considerations of this problem is the position of the temporomandibular joint in the occlusion presenting irregularities. In an earlier paper,[1] I differentiated the normal position occupied by the condyles in the mandibular fossa in the three broad classifications of bites. With comforting results in more than 300 additional cases to support this classification, I have recorded a position of displacement that is present in cases of occlusal strain. This definite diagnostic record indicates the presence of disharmony in occlusal relations.

The type of bite definitely determines the shape of the articulation. In a broad classification, bites fall into three general groups: the normal overbite, the edge-to-edge bite and the marked overbite.

The joint presents the following physical characteristics, which may be considered as standard when normal mandibular articulation is mentioned:

1. (a) The temporal surface presents a smooth, even, comparatively shallow fossa and a full contoured articular eminence. (b) The condyle in the sagittal plane is somewhat elliptical and is tilted forward slightly. (c) The articular relationship with the teeth occluded is between the upper part of the anterior surface of the condyle and the posterior surface of the articular eminence. (d) When the mouth is opened to full normal limits, the condyle occupies a position directly below the crest of the articular eminence. (Fig. 1.)

2. In the edge-to-edge bite, the cutting edges of the maxillary anterior teeth meet the mandibular teeth edge-to-edge. This group presents the characteristics of the flatter inclination of the angle of the articular tubercle and flatter articular surface of the condyle head, and a more vertical course of the mandibular neck.

3. In the deep overbite, the incisal edges of the mandibular teeth very often touch the upper gum line lingually. Hinge or rotary function is predominantly practiced in this type of bite. It is characterized by markedly convex articular surfaces of the condyle and articular tubercle, and a steep angle of inclination of the tubercle, with a decided forward tilting of the mandibular neck. The condyle process shows the effect of the rotary action.

ROENTGENOGRAPHIC CLASSIFICATION

With the classification of the three types of bites recognized, the temporo-

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mandibular joint may be roentgenographically demonstrated. Three physiologic groups and three pathologic groups can be differentiated, with the characteristics of the previous classifications as their basis.

Physiologic Group.—Group 1 (Fig. 2, A and B): The normal joint. This is suited to the combined motions chiefly found in the normal overbite, presenting the following characteristics in the centric position: (a) a natural convexity to the articular surface of the condyle head and articular eminence; (b) a moderate forward tilt of the neck of the condyle, and (c) a moderately shallow mandibular fossa, not too deep. There may be

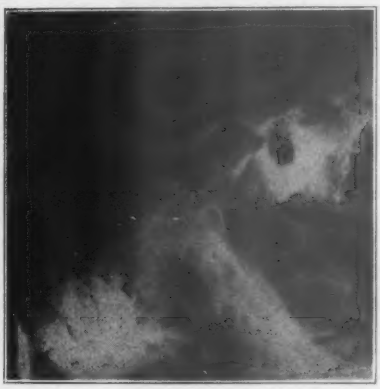

Fig. 1.—Fossa, eminence and tilt of condyle head in lateral projection of temporomandibular joint.

individual variations to this, however. The head may be delicate or coarse, and the neck of the condyle may be tilted more vertically or horizontally; etc.

Structurally, roentgenograms of the normal adult show a distinct trabecular arrangement of the condyloid process and articular tubercle, together with the lamellae of the compact outer bone.

In the open position, the condyle comes to rest directly below the articular eminence, when the mouth is opened fully, within normal limits.

Group 2 (Fig. 3, A and B): The flattened gliding joint. In this group, the joint has been reshaped to accommodate itself to gliding function. It is found chiefly in the edge-to-edge bite. Roentgenographically, it reveals the following in the centric position: (a) flat bony articular surfaces of the condyle head and articular eminence; (b) a very slight angle of inclination of the neck of the condyle, and (c) a flat horizontal course in the roof of the mandibular fossa.

Group 3 (Fig. 4, A and B): The marked convex joint. In this group, the joint has been transformed to accommodate itself to rotary function and is found chiefly in marked overbites. Its roentgenographic characteristics in the centric position are: (a) marked convex articular surfaces of the condyle head and articular eminence, both more prominent; (b) an exaggerated forward tilt of the condylar neck; (c) a deep mandibular fossa, and (d) a reduced disk space, interpreted as deeply compressing the meniscus.

Pathologic Group.—The first of the three pathologic groupings may be subdivided into two classes, differentiated through abnormal position, not structurally.

Group 1: Subclass A: In the closed position, the condylar process has been displaced superiorly and posteriorly in the mandibular fossa when the teeth are closed in centric position.

In the open position, with an unforced opening, the condyle does not reach the peak of the tuberosity as it should, but is arrested on the posterior third of the articular eminence. (Fig. 5, A and B.)

Subclass B: In the closed position, the condylar process is displaced posteriorly and superiorly in the mandibular fossa in centric position, but, in the open position, an excessive excursion is found typical. (Fig. 6, A and B.)

Group 2: This group, which delineates joints in which the end result is a diskless sliding joint, may be found in all

types of bites. It has more distinguishing characteristics for diagnosis, roentgenologically and morphologically, than the others (Figs. 7, A and B, and 8): (a) clearly outlined projections or jags on the anterior or posterior margins of the joints; (b) coarse bony jags on the articular planes of the articular eminence; (c) steep tubercle with flat surfaces of the condyle, or vice versa, and (d), the tionally organized connective tissue, and, from these newly formed points, there issues normal fibrocartilage tissue, which is able to adapt itself in taking over the changed function.

The foregoing is the picture of the normal joint roentgenographically, with the variations and morbid conditions that are the result of obvious mutilation and loss of vertical diameter. But where there is

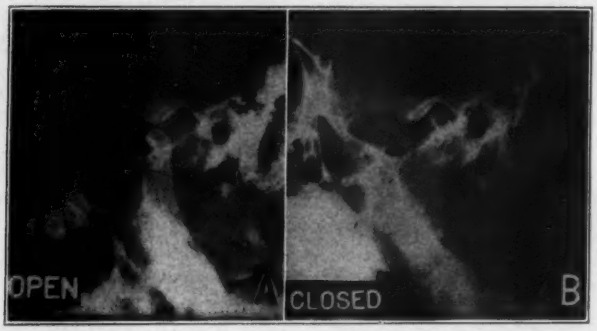

Fig. 2.—Group 1. Temporomandibular joints of normal overbite in open and closed position. The fossa and articular eminence are well contoured. There is a normal tilt to the condyle head, and a correct terminal of the excursion in the open position.

Fig. 3.—Group 2: Joints of edge-to-edge bite; flat articular eminence, shallow fossa and vertical flattened head of condyle.

end-result, flat articular surface of both the condyle and the articular tubercle.

The decartilaged places on the articular planes of the articular tubercle and condyle are filled out by subchondral marrow spaces with a new layer of func- even a full complement of teeth which are arranged in correct vertical height but in disharmony, there is still another definite picture that registers on the roentgenogram to which I should like to direct particular attention. Disharmonies in

occlusion may thus readily be recognized. This constitutes the third pathologic group.

Group 3: This group is seen roentgenographically as either a posterior displacement or an inferior displacement of the condyle head in the mandibular fossa. It may occur singly or as a combination of both positions. It is a manifestation of strain in the joint.

This is the registration as seen in the lateral projection. When the joint is viewed in the anteroposterior projection, or in the vertex-mental position, we find it also assumes either a lateral or a medial displacement from the midsagittal plane.

The natural human temporomandibular joint is not a precision, tight articulation where the slightest deviation from

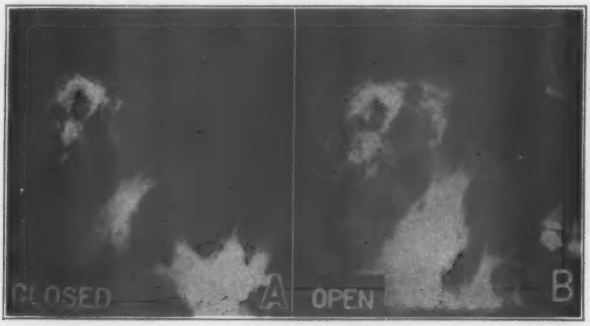

Fig. 4.—Group 3: Joint of deep overbite; large articular eminence, deep fossa, noticeable forward tilt of condyle head and reduced disk space.

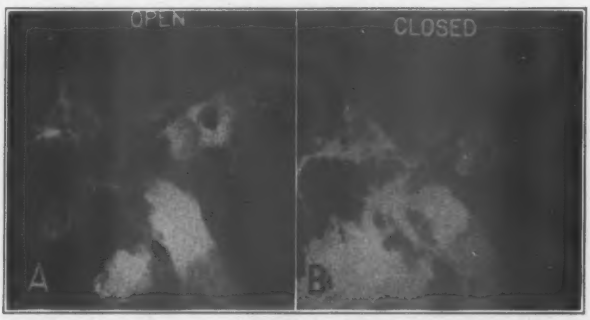

Fig. 5.—Pathologic Group, Subclass A: Superior displacement in centric relation; open position, insufficient excursion.

Posterior displacement results more often from occlusal disharmony, whereas inferior displacement is positional, and usually a result of tooth guidance. It is readily amenable to normal correction by equilibration of the occlusal relations of the teeth. (Figs. 9, A and B; 10, A and B; 11, A and B.)

the normal will produce immediate and violent reaction. It is fairly loose and of accommodating tension to permit the lateral excursive movements that mastication demands. However, since tissues such as the tendons which limit the movement of the joint do not stretch in the ordinary sense, but tear and repair when

subject to a traumatic reaction, any abnormal excursive path or the unnatural arrangement of the tooth position will cause abnormal tension in the temporomandibular joint. This tension is manifest in the roentgenogram as the referred inferior and sometimes posterior displacement of the mandibular condyle in the mandibular fossa. (Fig. 12.)

It is very helpful in a clinical examination to determine whether strain is present in a joint to have the patient move the jaws in either right or left eccentric excursion. This will demonstrate their accommodation to this movement, and also determine which is their favorite site of mastication. We find very often that they are unable to effect this movement on one side. This will probably be the normal side of occlusal relations, but abnormal side for condylar conditions. A roentgenographic check-up will show that the condyle of the side selected for mastication has been injured or crippled. (Fig. 13.) This is easily understood when we consider the physiology of the musculature of the region. The external pterygoids initiate and control lateral jaw thrusts in eccentric relation. If the insertion of one side is disturbed through injury, or impairment or atrophy of the muscles through disuse, the mandibular condyle head of that side will not execute the normal physiologic action, and

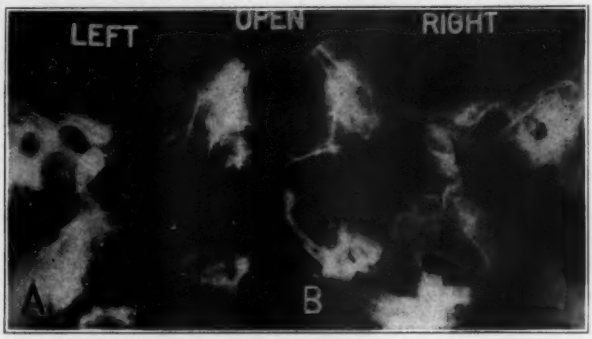

Fig. 6.—Pathologic Group 1, Subclass B: Excessive excursion of right condyle head in luxated position; normal terminal of left.

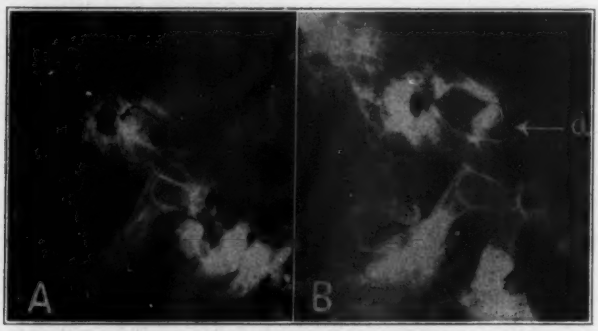

Fig. 7.—Pathologic Group 2: Arthritis deformans; mushroom appearance of condyle head with elimination of disk space and destruction of articular eminence. The opening position shows a sloughing projection on the anterior margin of the condyle (a).

a lateral eccentric thrust to the opposite side cannot be practiced without severe pain or discomfort, if it is accomplished at all.

For example, if the patient selects the right side to chew on, we may expect the left condyle to execute normal excursions. the sense of a rotating center and often manifests morphologic and positional changes as a result of its restrained activity.

The site of mastication may be selected on the basis of the efficiency of the remaining teeth in a mutilated occlusion

Fig. 8.—Cross-section in condition similar to that in Figure 3. The disk has been destroyed. a, anterior marginal jags; b, remains of disk; c, eroded surface of condyle head. (After Steinhardt.)

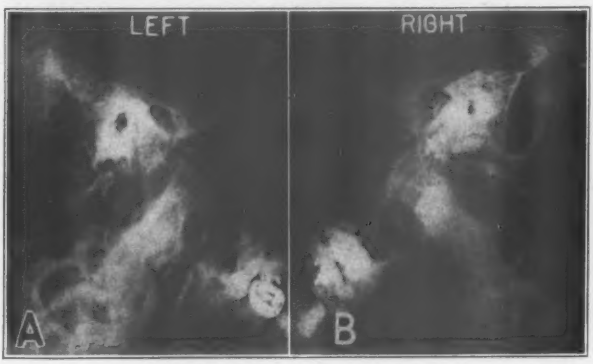

Fig. 9.—Group 3: Posterior condylar displacement with full complement of teeth, result of occlusal disharmony.

Sometimes, however, through unrelieved practice, it suffers abuse, and manifests morphologic changes; whereas the condyle head of the right side acts more in to reduce food to assimilable form, or because premature, traumatic contacts of the opposite side which produce pain prevent its relief to the other side.

In planning the treatment, we have to consider the discrepancy in the size and form of the two rami, as a result of the stimulus of unequal function. If this is apparent at the start of treatment, allowances can be made for this imperfection through exercises and instruction in masticatory habits to help adjust this deficiency. This may become apparent to us by simply taking a roentgenogram of this region.

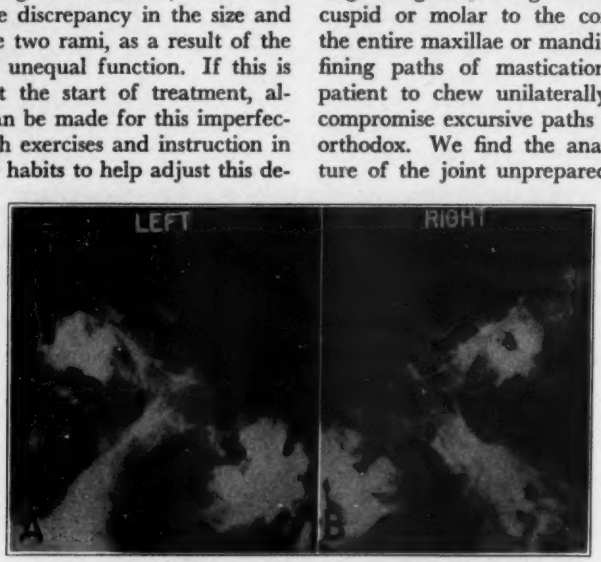

Fig. 10.—Inferior displacement, particularly of left condyle head, as result of occlusal disharmony.

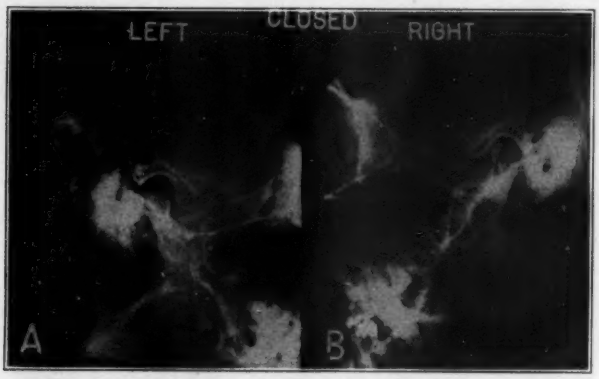

Fig. 11.—Marked posterior inferior displacement of condyle head on left side. The right side is normal. The left articular eminence was destroyed and the form of the condyle head was altered.

The most destructive type of bite in which this phenomenon is usually found is the cross-bite. This may range from a single lingual locking of a cuspid, bicuspid or molar to the contraction of the entire maxillae or mandible. Its confining paths of mastication cause the patient to chew unilaterally and select compromise excursive paths that are unorthodox. We find the anatomic structure of the joint unprepared to support the strained relation, and it gives way to an altered mutilating reaction resulting often in severely painful conditions.

When there is a locked bite unilaterally and the patient is forced to chew on one side of the mouth, the condyle manifests

the same reaction as bone anywhere else in the body (Fig. 14) with a change of form in response to pressure. The condyle of one side, acting as the pivotal point in an excursion during mastication, is subjected to a rotating pressure and, in time, will bend itself around at the neck and head as a result of this continued insult.

After this bite is freed, however, the patient may still attempt to practice unilateral mastication, through habit, on the favored side, unless he is forced to relinquish it because of a developing pain or fatigue. This suggests an important fact in considering successful therapy. We are dealing with a problem of orthopedia. Modern orthopedics, after corrective operative procedures, often requires patient and protracted muscular exercises and instruction before the corrected member can be considered as functioning normally again. Therefore, the dental patient must be directed and instructed to chew correctly on the unpracticed side, if discontinuance of the abuse that led to the original problem of treatment is to be expected. (Figs. 15, 16 and 17.)

Bone repair of condyle heads that are destroyed or deformed offers very poor prognosis. We can expect only meager reparative changes in the mutilated condyle heads in cases of trauma.

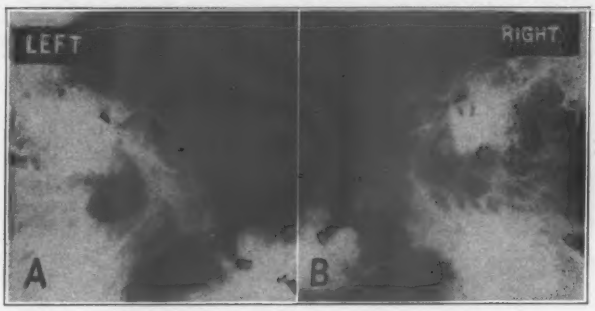

Fig. 12.—Trauma to condyle head of right side in case of posterior inferior displacement.

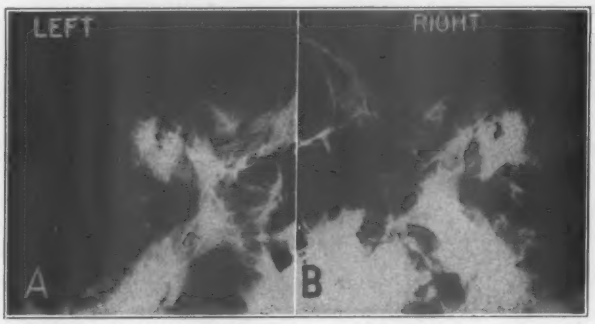

Fig. 13.—Traumatized roof of mandibular fossa and anterior margin of condyle head, condition due to occlusal disharmony induced by unilateral mastication. There is loss of outline of the cortical bone in the fossa.

In reconstructing the original denture by retracing the steps that led to the destruction of the bite, it will be seen that the process was one of slow progression. The first misstep probably was an im-

properly placed repair of one of the tooth surfaces through carious invasion. As pathosis continued, premature loss of the tooth might have resulted. The next misstep might have been one of commission, or omission. Either an improper replacement was made, in conflict with the occlusion, or, the more damaging error, the mutilation was not corrected, with the result that the contact forces of the two approximating teeth and the antagonizing occlusal force were lost. There might also have been an abnormal development of natural occlusal forces resulting in a cross-bite or locked bite. Restriction of excursion that followed resulted in development of an unnatural condylar path and, in turn, unilateral occlusion during function. This manifested itself in an asymmetrical development, as noted in the preceding examples.

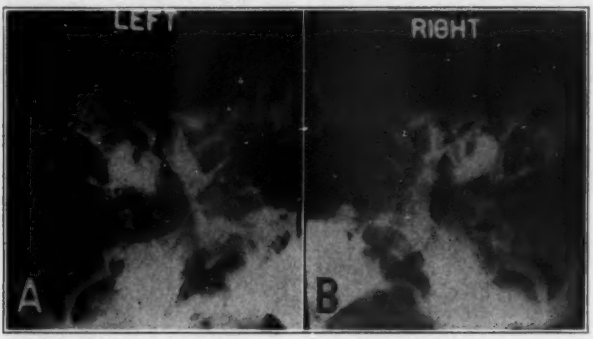

Fig. 14.—Discrepancy in size of right and left rami in patient who employs unilateral mastication.

Fig. 15.—Front and profile views and bite in case of prognathism and crossbite which has thrown jaw to right. A: Before treatment. B: After treatment, showing correction of midline of face.

WHEN NOT TO RAISE THE BITE

It it natural to believe, and actually is

true, that, in attempting reconstructive therapy, we cannot correct in one single application of adjustment a process that required years to develop, and then developed only after passing through transitional traumatic stages.

Inserting splints which will subsequently be replaced by a more permanent form of restoration will unquestionably change the occlusal relation, but may not be the corrective therapy to benefit the patient. It may merely mean transferring the manifestation of occlusal discrepancy and trauma to a new plane. This change may lull the patient into the belief that correction is permanent because some of the symptoms of the original complaint have disappeared, through freeing locked cusps, but actually it is only extending the disturbance by foisting the same defects on tissues that were not subjected to the initial reaction. It is only a matter of time until these tissues will show the same destructive change as the original, and the failure of the incorrect therapy will be even more apparent.

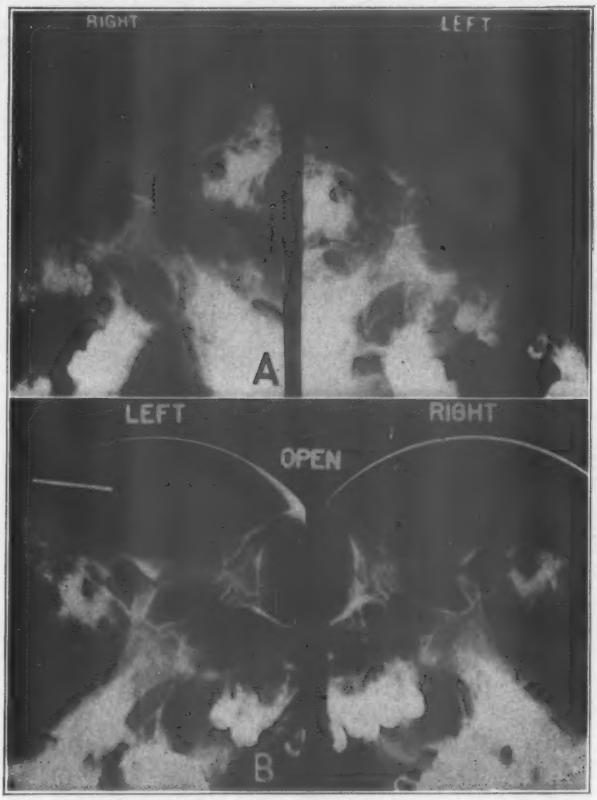

Fig. 16 (A).—Condylar position of case shown in Figure 15, in opening process 3.5 cm. before treatment, showing excessive excursion.

Fig. 17 (B).—Case shown in Figure 16 after correction of the bite. The condylar heads have the correct terminal position while opening the same distance of 3.5 cm. in the incisal region.

It has been the earnest but misguided effort of dentists to correct a discrepancy in jaw forms such as a Class II (Angle), distoclusion case where the position of the lower jaw is posterior to that of the maxillae, by grinding the occlusal surfaces of the teeth to permit them to bite forward, or by achieving a correct centric protrusive relation, and building up the space in the molar region with some form of bite replacement, such as is afforded by inlays or overlay clasps, in the space left by this forward placement of the mandible. (Figs. 18, A and B; 19, A and B.)

Such a correction will result in failure, since it does not attempt to treat the underlying cause. This is true in cases both of unilateral and of bilateral posterior occlusion. The temptation to gloss over this fundamental error in occlusion by creating an esthetic correction is very strong. This desire for cosmetic improvement is laudable and, in some instances, warranted. But if this were a successful form of therapy and basically correct, what an unnecessary and irksome procedure orthodontia would be, attempting to correct these defects by a slow stimulative process through a period of years!

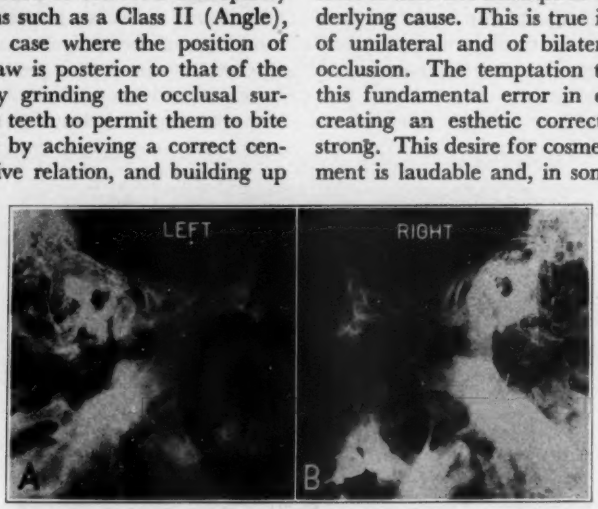

Fig. 18.—Posterior displacement of condyle in case of posteroclusion.

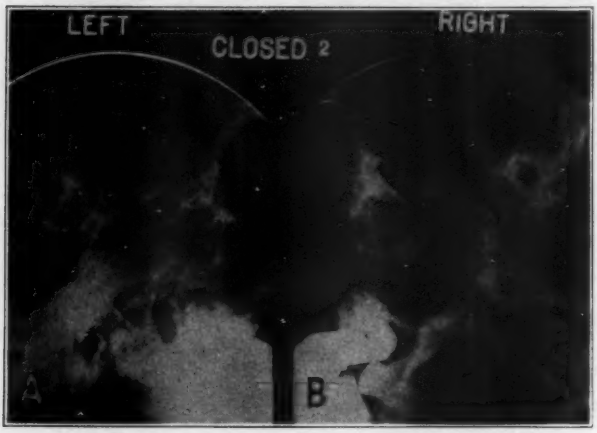

Fig. 19.—Case shown in Figure 18; with mouth closed and patient wearing a bite plane. The condyles have been moved out of the fossa to the position that they should occupy only when the mouth is widely opened.

If the initial deficiencies are realized, we shall be that much closer to harmony and success in our adjustments, and extravagant promises that prove untenable in a short while will not be made to patients.

In cases of posterior-inferior displacement where bite raising is attempted, there will be little alleviation of the symptoms or improvement of the condition. All that will be accomplished is the transfer of the problem to a newer plane.

When the external pterygoid muscles failed, the condyle heads were permitted to retreat deeper into the mandibular fossa, and they no longer used the disk as a movable path on which to travel, but pushed it in front at every opening of the jaw. Consequently, the opening and lateral movements of the jaw were rather limited, being dependent on the flexibility of the capsular fibers and the ligaments of the part. This condition of articulation with its subsequent injurious possibilities need be present only unilaterally. The unilateral restricted function alone should be an alarming symptom for dental consideration. Whereas the jaw of the healthy side functions perfectly, the condyle process of the pathologic joint can usually travel only half way along the posterior surface of the articular tubercle. (Fig. 20, A and B.) Also, at every lateral movement, the articular tract changes according to the

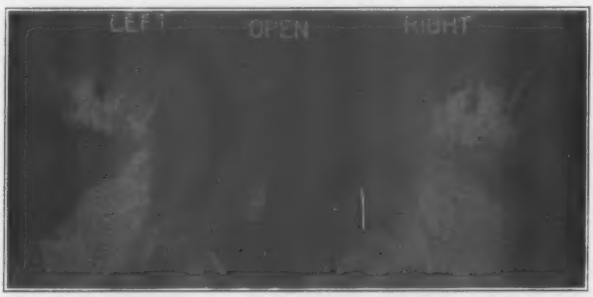

Fig. 20.—Condyle head of right side blocked by meniscus torn from normal attachment; mouth open 3.5 cm. It does not leave the fossa as it should do as seen on the left side.

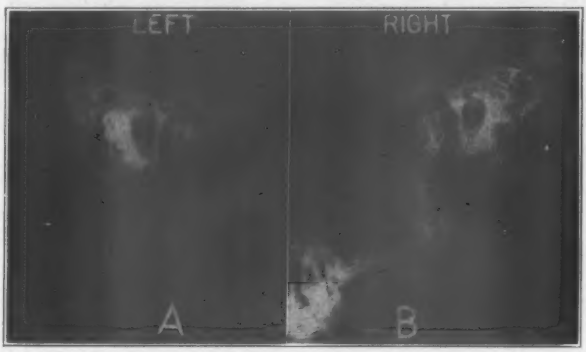

Fig. 21.—Right condyle in protrusive action without benefit of buffing meniscus, at moment of click, in bony contact with articular eminence; left condyle at same moment.

wedging of the disk. Consequently, these cases present no constant articular paths, and it is futile to make any individual measurements, since unending variety may be expected in what one may term behavior patterns of jaw movement. Does this suggest the possibility of fallacy in the registrations of anatomic articulators in the construction of dentures?

If this is true in unilateral conditions of the joint, it is doubly so if the two joints show similar conditions. In addition to the injury induced by disk displacement through muscle failure, there are injuries resultant from the position of the condyle in its abnormal placement, and steps should be instituted to reposition the condylar head to its normal relation on the posterior surface of the articular tubercle.

This is not accomplished by simply raising the bite and assuming that the condyle head has been lifted to its new position in the fossa in correct normal relationship with the rest of the structures. If the bite is raised within the normal limits of opening, even up to 8 mm.; and the mandible has been maintained in *centric relation,* it is surprising, but true, that the condyle remains in the same relative position in the mandibular fossa anteroposteriorly as it occupied while in centric position at the lower maxillomandibular level. The only reaction it manifests to the increased height is a slight rotation, with the rotary center

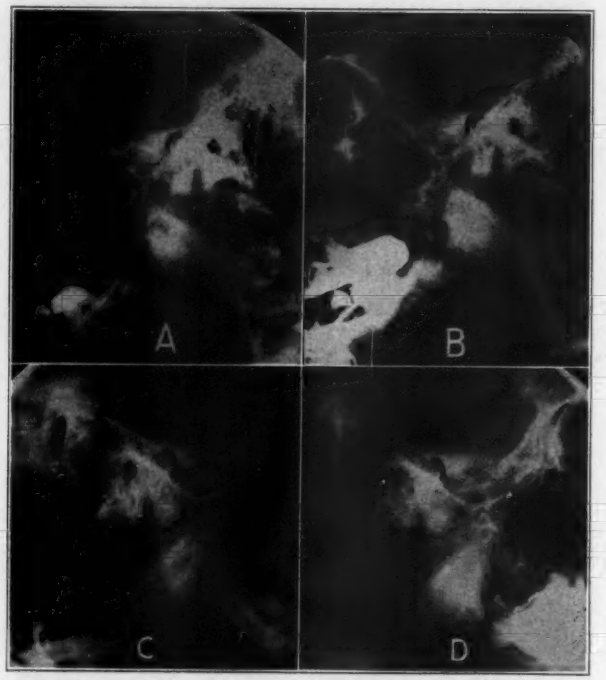

Fig. 22.—Absence of change in condylar positions when splint was placed to raise bite to alter fossa relation. Left, without splint; right, with splint. Normal reactions do not occur in abnormal joints.

in the condyle head. Raising the bite lifts the condyle process down out of the fossa sometimes, and repositions it a little farther forward, when it is not checked in centric position and is allowed a slight protrusive position; but since it does not go the whole way, a greater forward strain is created on the disk by a tenser impingement. Steinhardt and Langen say that this can be better accomplished by first depressing the jaw manually in a downward direction to overcome the posterior thick portion of the disk behind which it is locked and then pulling it forward. In this way, the condyle head is replaced in its normal relation. If successful in this, we may expect the replacement to be successful, because the condyle process will then be retained permanently by the articulation in its normal position at the posterior surface of the articular tubercle.

This can be done if the disk retains its shape somewhat and the tissue of the disk is not disintegrated. Since such joints have remained more or less in a normal condition, whereas the condyle heads have been pushed up into the mandibular fossa, there is great likelihood that the condyle process can be maintained in its normal position by the posterior thickened portion of the disk. But if the condyle heads cannot maintain their normal position, even temporarily, through impairment of the disk, success of any prosthetic replacement is very doubtful. Its former solid tissue has been changed into an unelastic and relaxed structure which is disturbed every time the jaw is opened.

Patients will come to us for diagnosis of pain in the temporal region because the restored occlusal plane was modeled on a raised bite determined solely by the profile of the face, without regard for the topographic position of the condyle head; whereas such a consideration would have shown that the disk was pulled forward because the posterior capsular fibers were subjected to a strained tension finally resulting in their rupture and the eventual destruction of the disk. An occlusion modeled on such a movable and changing support will soon manifest its merely temporary usefulness because the condyle paths to which it was constructed are not correctly adaptable to it.

Thus, it can be seen that all pains in this region cannot be alleviated by raising the bite. Although the problem may unquestionably be one of disturbed occlusion, through mutilation, attrition or deficiency of development, these vague pains, with their sequelae, are very often the product of a disturbance of the excursive path of the condyle in the process of moving the mandible. This being so, it is amenable to more than the single treatment of bite raising. Orthodontia, periodontia, operative dentistry and oral surgery have recorded case histories with results to substantiate this.

Any hindrance to the practiced excursion path of the normal condylar head, in the nature of an unbalanced bite, through mutilation, malocclusion, etc., will induce the patient to select a new track for masticatory excursion to avoid the unpleasantness or painful reaction that accompanied using the accustomed paths. In seeking greater efficiency during mastication, the patient seeks a new excursive path, because of either a high inlay or the loss of an antagonizing contact. Sometimes, the force of the inclined planes of the teeth directed the occlusion, and thus the condylar heads, into new excursive paths.

The constant repetition of the practice takes its toll on the structures that guided the temporomandibular joint in its daily function, and soon there is manifest a tearing, loosening and bunching, or stretching, of the muscles of mastication and supporting ligaments, which makes itself felt in the reaction of pain. (Fig. 21, A and B.)

Judicious grinding of a tripping cusp, from a gold inlay or an elongated tooth, very often is all that is necessary to alleviate these pains and permit the condyle to assume once more its normal excursion path, and thus permit these strained structures to heal and react to a normal environment.

Perhaps it does not need more than a replacement of a tooth in a neglected sector of the mouth that drives the patient to a habit of unilateral mastication or the correction of a cross-bite through orthodontia; or perhaps a combination of these.

Where the loss of a tooth in the arch results in no change in the vertical diameter of the face, normal height is maintained. This is mirrored in a normal anatomic relation of the condyle head in the mandibular fossa and its associated structures; i.e., articular disk, ligaments and muscles.

Where a deep overbite occurs as a result of supraclusion of the upper and lower anterior teeth and bite raising is the gesture of correction, it results in failure. This occurs because a normal bite height is increased grotesquely to correct a deficiency of the anterior teeth. An abnormality is compounded on an abnormality in an attempt to create a normal. Naturally, it cannot succeed.

HEARING DISTURBANCES

If the articulating surfaces of the temporomandibular joint are brought into traumatic relation, something is going to give way: the articular disk, the condyle head, the articular tubercle, the mandibular fossa, one or all, with secondary involvement of the contiguous structures, such as the ear or the terminal structures, the teeth.

The manifestations of hearing impairment through actual involvement of the eustachian tube and tympanic structures as a sequel to this disturbance of temporomandibular function are receiving increasing attention and recognition not only from dentists but also from otolaryngologists. The disturbance of function results in a syndrome of ear symptoms which are a source of deep concern and great discomfort to the patient. The number and variety of symptoms reported in medicodental literature in association with malocclusion are increasing daily. Some of those affecting the ear were reported by J. B. Costen,[2] an otolaryngologist.

I have found painful symptoms localized in the region of the masseter muscle, extending over the region of the sternocleidomastoid muscle and manifesting themselves forward along the route of the superior maxillary division of the fifth cranial nerve, following it to the terminal infra-orbital branch. A burning sensation in the pharynx and anterior section of the tongue and the side of the nose; dryness of the mouth, with almost total absence of saliva, and occasional herpes of the external ear canal and buccal mucosa, most marked on the mutilated side, were emphasized by Costen.

The anatomic reasons advanced for the pain were (1) erosion of the bone of the mandibular fossa, and impaction of the condyles against the thin bone, separating them from the dura and its rich nerve supply; (2) irritation from the uncontrolled movement of the condyles backward or mesially of the auriculotemporal nerve, which passes close to the mesial side of the capsule, between the condyle and the tympanic plate, to distribution over the temporal and vertex region, and (3) production of reflex pain and sensory disturbance in the various connections of the chorda tympanic nerve, the condyle irritating it where it emerges from the glenoid fossa through the petrotympanic fissure.

E. Greene[3] advances the hypothesis, over Costen's explanations, that proprioceptor nerve impulses transcending the normal threshold and communicating

with the central nervous system cause the disturbances.

E. P. Seaver, Jr.,[4] another otolaryngologist, says:

> While the diagnosis of temporomandibular joint malocclusion is simple, the difficulty is to evaluate its importance as a factor in ear disturbances. Trial bite opening affords good evidence. Loss of proper position of the condyle in the glenoid fossa results in neuromuscular mechanism in the inner ear. The resultant effect will vary the stage of irritation. The whole symptom-complex will be associated with other local and systemic factors and the whole picture will vary with the individual behaviour.

With the increasing interest in the temporomandibular joint, recommendations appeared more regularly in our literature for the cure of the symptoms associated with temporomandibular disturbances. It was recommended that a cork disk, splint or bite-plate be placed between the teeth to move the mandible downward and forward in the mandibular fossa. Only by checking these procedures with the x-rays was it determined that the expected downward and forward position was not the universal reaction to this therapy. In some instances, the condyle heads were driven further posteriorly and downward. (Fig. 22.) This led to a differential diagnosis that only those cases that were superiorly displaced in the mandibular fossa were amenable to this form of correction. Those cases that showed an inferior or postero-inferior position of the condyle head in the mandibular fossa, if so treated, showed only an exaggeration of or no change in their original position. This cautions one against uncertain procedures. Other problems than bite raising are involved.

We must not fall into the easy error of cataloging all symptoms under sharply defined causes, and when they are thus segregated and pigeon-holed, employ a limited and restricted therapy.

Our human machine can never be made to conform to this approach, and dentistry has too much to offer to be confined to a form of single therapy as the panacea for all such conditions.

In presenting a new and recognizable position of the mandibular condyle when the temporomandibular joint is under tension as a result of occlusal disharmony, as demonstrated by the roentgenogram, I am offering a new consideration for determining when we are justified in instituting certain procedures in moot cases. This will serve as a differential diagnosis in considering when bite raising is contraindicated and what reasons there are for unorthodox excursions of the condyle, with their painful reactions. It will also advise us as to when we can dismiss orthodontic cases with the expectation of continued normality so that retention may assure an enduring result. All this may be determined with the help of roentgenographic examination of the temporomandibular joint.

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136 East Thirty-Sixth Street.

PORCELAIN PONTICS

By Ralph C. Cooley, D.D.S., Houston, Texas

IN pursuing the ever elusive but always interesting subject of combined esthetics and mechanics in fixed bridgework, consideration of the subject of individual porcelain saddle pontics is both essential and timely.

So far as information is available, these were first designed and introduced to the dental profession about twenty years ago by E. T. Tinker, of Minneapolis.

It is a sad commentary on progress in this most important branch of dental art and restoration that, after the lapse of approximately two decades, we still have universally available only one stock porcelain tooth suitable for a porcelain pontic, and that tooth, because of its faulty design, so limited in its application that we cannot consider it as fulfilling our requirements to any substantial degree.

It is most unfortunate that the many operators who appreciate the results obtained only in fixed bridge restorations, yet persist in constructing this type of bridge at whatever sacrifice of time and effort, are through necessity forced to resort to such extremities as the baking of saddles on pin facings, or to constructing inverted pontics on stock porcelain crowns, or to the baking of pontics in their entirety, all because no suitable stock pontic has been made available to meet our urgent requirements.

It is possible also that many of the members of our profession, especially the younger members, have been driven to the insertion of removable types of bridges, in situations where the fixed types were indicated and preferable, simply because they did not possess the technical skill to construct their own porcelain pontics.

Fig. 1.—Undercut triangle and slot type of pontic.

Fig. 2.—Backing about to go to place.

The problem of individual porcelain saddle pontics and their construction, especially as it relates to the proper attachment of each to its supporting metal, has absorbed my attention for the past fifteen years, during which time I have constructed hundreds of designs. From these, three have been selected and are submitted here.

My specifications for an ideal individual porcelain saddle pontic, as a result of this extended study, are as follows:

1. The porcelain itself must fulfil the purposes of strength and esthetics.

Read at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 14-18, 1938.

2. The two supporting planes must present an obtuse angle, one to the other, preferably an angle of from 100 to 115 degrees.

3. The porcelain pontic must have ample attachment to its supporting metal.

4. The form these attachments assume must present ample strength in its supporting metal.

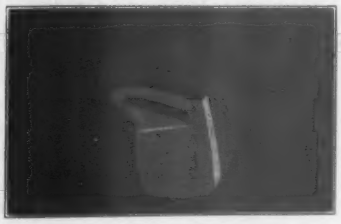

Fig. 3.—Complete pontic with backing in place.

Fig. 4.—Undercut and inverted pin type pontic.

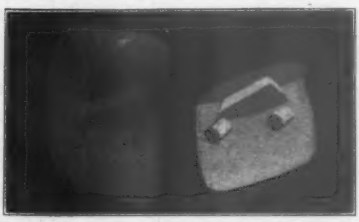

Fig. 5.—Undercut and inverted pin type pontic.

5. The form these attachments assume must not weaken the porcelain pontic.

6. The attachment of the supporting metal to the porcelain tooth should be strongest within the labial or buccal plane, which is the plane upon which stresses are exerted, and less strong within the gingival plane attachments, which are merely stabilizing and absorb no stress.

7. The attachment forms must be placed essentially close to each other upon these two planes and close to the center of the pontics for strength and to allow the operator ample opportunity to cut away, process or fit to the requirements of his case any of the margins or angles of the pontic without impinging on the mechanical attachment.

Fig. 6.—Undercut and inverted pin type pontic.

Fig. 7.—Three inverted pin type.

Fig. 8.—Three inverted pin type.

The pontics illustrated and described herein all come within the essential limits of these specifications.

The first is the undercut triangle and

slot type. (Fig. 1.) This presents what might be termed as an in-and-out lock; that is, when cemented together, the metal locks into the porcelain in the slot on the labial surface, whereas the undercut porcelain triangle locks into the metal on the gingival plane. The other views show the backing about to go to place (Fig. 2), and, finally, the complete pontic with the backing in place. (Fig. 3.)

The second is an undercut triangle and inverted pin type. (Figs. 4, 5 and 6.)

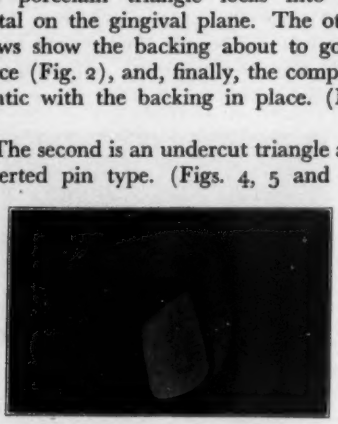

Fig. 9.—Three inverted pin type.

Fig. 10.—Anterior bridge utilizing pontics described in text.

This presents essentially the same planes, undercut triangle and attachments as the foregoing type, except that instead of the slotlock in the labial plane, two pinholes, parallel to each other and to the gingival plane, are substituted to permit cementation of the pins, which may be seen as an integral part of the metal backing.

The third type is the three inverted pin type. (Figs. 7, 8 and 9.) This pontic presents two flat planes with two pinholes in the labial plane and one in the gingival plane. The two holes in the labial plane are parallel to each other and to the gingival plane, whereas the pinhole in the gingival plane with a raceway or groove leading to it is parallel with the long axis of the pontic, and therefore is at an acute angle to the direction of the labial pins. This is an especially easy pontic to construct and process, and it presents, on cementation, the extreme in strength and stability of both units. Detail is more easily grasped in a close study of the metal backings.

These three pontics may be baked by an accomplished ceramist very much as he would proceed in baking a porcelain jacket crown, except that he would construct it as an entire pontic, slightly oversize to accommodate for shrinkage of the porcelain, then would carry it up in the porcelain furnace to a comparatively high biscuit bake. The attachment planes and detail may then be cut into it with stones and burs, and the pontic fused. The supporting metal is readily constructed by waxing a pattern and casting, in the usual manner, in any desired gold alloy.

Fig. 11.—Anterior bridge utilizing pontics described in text.

An anterior bridge utilizing the pontics just described is shown in Figures 10 and 11.

Attention is especially invited to the combined strength and esthetic effect re-

sulting. Although only anterior pontics have been described here, the description presented is equally applicable to and desirable for bicuspids and molars in posterior fixed bridge restorations.

May I not ask you to visualize what it would mean to you and me, and to our clienteles, were the following eventualities to materialize? That one or all of these porcelain pontics be manufactured and made commercially available to us. Then we could add eighth and ninth valuable specifications to the seven already enumerated; namely, standardization of specific molds, and interchangeability and replaceability.

Stock backings could be furnished, as illustrated, in order that we might cast the desired additional metal upon them; or, better yet, metal backings might be made available to us as a completed restoration of the lingual surface of the pontic.

We would then have but to select pontics for shade and size, process them together to suit the requirements of the case, adapt the saddles, add the completed metal back, adjust the occlusion, invest, solder and finish the case.

This would effect a saving to us in time of perhaps 50 per cent or more, which, passed on to our clientele, would make this excellent type of bridge restoration available to many thousands who are not now able to enjoy its benefits.

Gulf Building.

HYDROGEN PEROXIDE AND SODIUM PERBORATE: THEIR COMPARATIVE ORAL IRRITANT ACTION*

By Samuel Charles Miller,† D.D.S.; Sidney Sorrin,‡ D.D.S.; William H. Greenhut,¶ D.D.S., and Rudolph H. Pelzer,§ B.S., D.D.S., New York City

INTRODUCTION

CONSIDERABLE perplexity persists in the mind of the dentist concerning the rôle which hydrogen peroxide and sodium perborate should assume in his practice. In one extreme is found the indiscriminate and unguided use of these agents by the patient, recommended for the maintenance of oral health. Opposing this view is that which holds these drugs to be indicated only in certain conditions of oral disease and as to be prescribed for temporary use only as specific therapeutic agents. The basis of the latter view relates particularly to certain untoward effects which have been described as following the continued use of these materials in more or less concentrated solution.[1-3]

An experimental approach to the problem was therefore formulated to attempt a solution of some of the questions relating to the use of hydrogen perox-

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*This experimental study was made possible through a grant from the Oakland Chemical Company.

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ide** and sodium perborate,†† and the nature of the deviations from the normal, observed clinically, microscopically and bacteriologically, which seemingly resulted from their use. Particular efforts were made to control the work so as to avoid other causations of tongue pathosis (the so-called "black" or "black hairy" tongue).

The chemistry of the two materials under investigation has been so thoroughly discussed in the literature that it need not be repeated in this presentation. Those interested in the literature will find it amply represented in the bibliography at the end of this paper.[4-9]

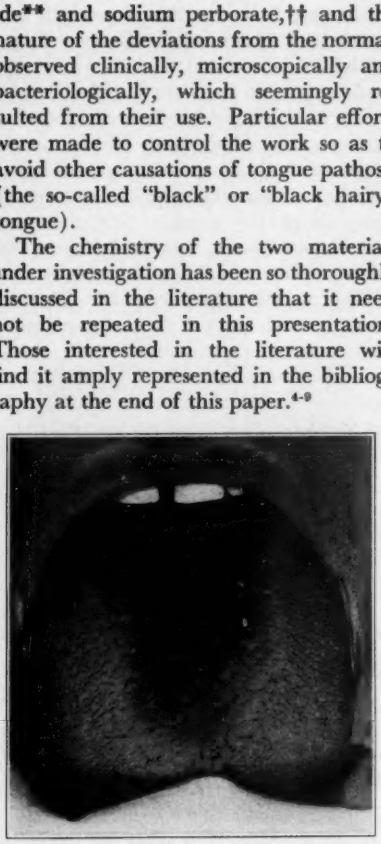

Fig. 1.—Lingua filaceosa chromatica localized in areas 1 and 2. (Compare Fig. 3.) The prolongations were dark brown. Slight difficulty in movement of the tongue and a boardlike feeling were reported by the patient.

LINGUA FILACEOSA CHROMATICA (BLACK TONGUE)‡‡

(Colored Filamentous Tongue)

The synonyms for the condition commonly called black tongue are numerous, including such names as lingua nigra, black hairy tongue, hyperkeratosis of the tongue, nigrities linguae, glossophytia, lingua villosa nigra, keratomycosis lingua, melanoglossia and melanotrichia lingua. These terms are used interchangeably to describe a disturbance of the filiform papillae showing patch formations on the dorsal surface of the tongue anterior to the circumvallate papillae. (Figs. 1-2, 10-13.) There is general agreement among investigators that the patches are composed of elongated, hyperkeratosed filiform papillae of the tongue. (Figs. 11, 12, 14, 15.) There is considerable difference of opinion, however, concerning the etiology of this condition.

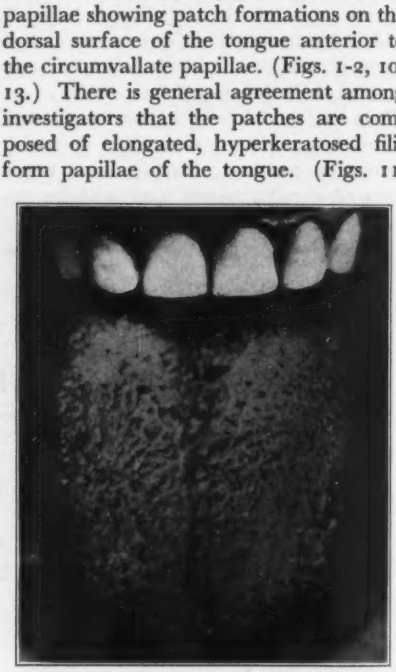

Fig. 2.—Lingua filaceosa chromatica generaliza. The entire tongue is a grayish white and furred. Subjective symptoms were stiffness and lack of freedom of the tongue movements.

Early writings show a definite tendency to ascribe it to the growth of a mold. Gottheil[10] and Heidengsfeld[11] isolated sporelike bodies from the filamentous growth. Ciaglinski and Hewelke[12] and Sendziak[13] similarly isolated and cultivated a black mold resembling a mucor,

**Dioxogen was the hydrogen peroxide used in this experiment.

††Merck's oral perborate was the sodium perborate used in this experiment.

‡‡This term has been introduced in this article as it describes the condition most completely. The justification is given later.

while Weidman[14] isolated a streptothrix. In an attempt to repeat this work, Goadby[15] found a large number of yeast forms associated with the condition, but he does not regard them as the cause of the disease. Mead,[16] in discussing the etiology, still includes the possibility of mold infection and, in addition, lists congenitally anomalous conditions, local or general irritation or infection, discoloration from food or drugs, and trophoneurotic disturbances. The last is strongly supported by Prinz[17] and Prinz and Greenbaum,[18] who hold that a constitutional state of this nature electively predisposes the surface of the tongue to irritation by

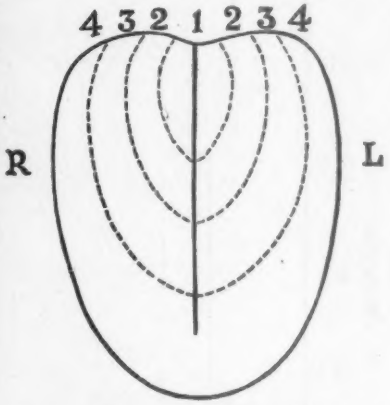

Fig. 3.—Diagrammatic representation of tongue map to facilitate recording location of tongue changes.

specific substances with consequent filiform papillar hypertrophy and matting. These authors further express the opinion that the parasitic microbic and purely hyperkeratotic theories are untenable.

The pigmentation is secondary in nature and is caused by external conditions, among which may be mentioned the eating of certain foods or condiments, the use of oxidizing and reducing substances in the mouth, and the ingestion of medicines, stimulants, various pigmented substances, etc. Prinz[19] writes:

> Primarily . . . these pigments owe their origin to a local chemical reaction occurring between the iron present in the blood, and certain sulfur and ammonia compounds derived from the decomposition of substances obtained from food débris or from tobacco smoke. Minute quantities of blood may be observed at almost any time near the free edge of the gum or between the teeth.

The various possible pigmentations in the condition described as "black tongue" include black, brownish black, yellow-

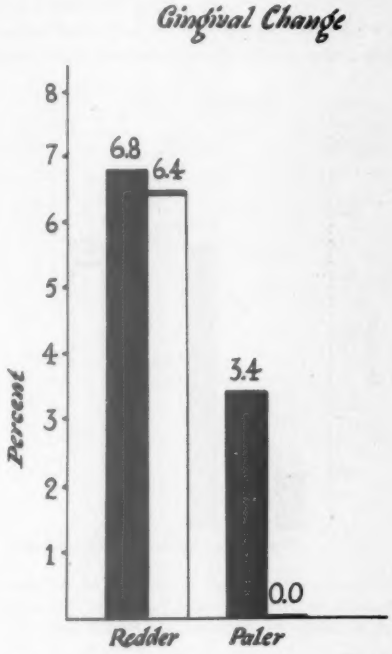

Fig. 4.—Percentage of gingival changes with hydrogen peroxide (black column) and sodium perborate (white column).

brown, green-blues and shades of gray.

The preceding brief review of the available literature on the subject indicates clearly that (1) the etiology of the condition is not definitely established and (2) the pigmentation may be caused by numerous conditions and is relatively unimportant. The term "black tongue"

has as its only justification its graphic description of a tongue that is black, but when used to describe a tongue that may as easily be of various other hues, it is not fitting. The use of the term "hairy" in describing the condition is equally unsatisfactory because the change in the filiform papillae is not in any way related to hair, save for a casual resemblance in gross appearance. To signify the filamentous nature of the tongue pathosis under consideration, and its relationship to any of various colors, the term *lingua filaceosa chromatica* is suggested—filaceous meaning filamentous and chromatic indicating its relation to color—the term therefore meaning "colored filamentous tongue."

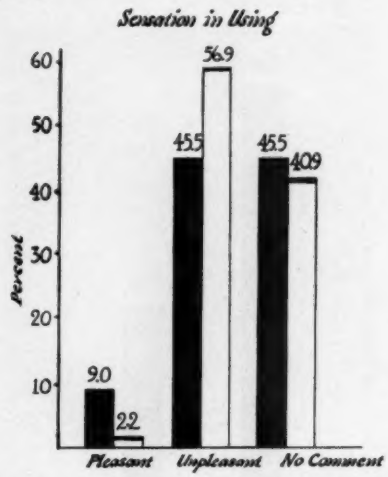

Fig. 5.—Percentage evaluation of subjective sensations with hydrogen peroxide (black column) and sodium perborate (white column).

METHODS USED IN THE EXPERIMENT

The necessity for establishing sound methods of procedure in studying a productive pathologic process of this nature is of the utmost importance. Various aspects of the investigation received consideration in the investigation under the following categories: (1) controlled clinical study; (2) pathologic study; (3) bacteriologic study; (4) rat experimentation, and (5) chemical study.

Clinical Study.—The cooperation of a number of students from the junior and senior classes at New York University College of Dentistry was enlisted. As a group, they represented the health and vigor of young adulthood, with a good education, intelligence, etc., making them ideal subjects, since what was to be done by them would not only extend over a period of time and have to be carried out consistently, but would also need to be subjectively interpreted. Solutions of such concentrations of hydrogen

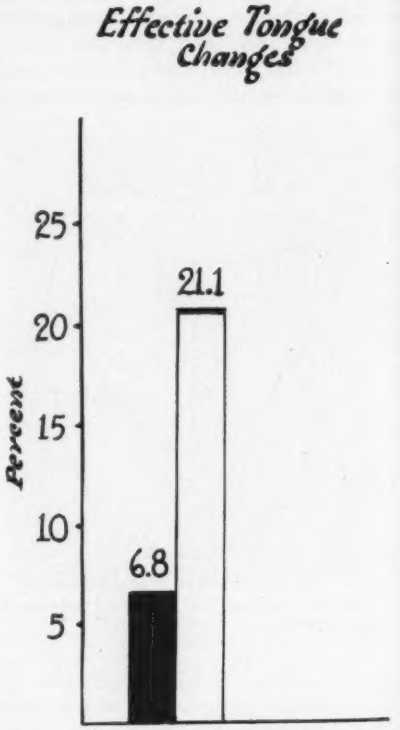

Fig. 6.—Effective tongue changes observed in experiment with hydrogen peroxide (black column) and sodium perborate (white column).

peroxide and sodium perborate as might lead to possible chemical burns in their mouths therefore could not be prescribed, for they would not be used by these informed subjects.

The entire number of students was divided into four groups, which were to use the materials as follows: Group I, only hydrogen peroxide; Group 2, only sodium perborate; Group 3, hydrogen peroxide for a period of time, then sodium perborate; Group 4, sodium perborate for a period of time, then hydrogen peroxide.

The last two groups were organized essentially to exclude the variable factor of individual differences which might arise with the relatively limited number of persons under consideration in the first two groups

The manifest difficulties involved in depriving the subjects of all alcohol and tobacco for a protracted period of time would have necessitated considering these substances as unknown variables, since such a regimen could not be strictly enforced. It was therefore deemed advisable to permit those who had acquired these habits to continue them in the usual manner, but to indicate each habit and its intensity, on a chart designed for the purpose.

This chart provided for such information as the name, sex, age, dentifrice in use before and after the experiment and drugs of any nature taken by mouth or by injection. Dietary data showed the nature of the diet ordinarily taken. To facilitate recording tongue changes, a tongue map with numbered areas (Fig. 3) was found to be most satisfactory. For the duration of the experiment, careful records were requested in regard to the material used, nutrition, the gin-

TABLE 1.—CHANGES IN GINGIVAL TISSUES, SUBJECTIVE SENSATIONS REGISTERED AND EFFECTIVE TONGUE CHANGE

Dentifrice Used	Total No. of Subjects	Gingivae				Sensation in Using						Effective Tongue Changes	
		Redder		Paler		Pleasant		Unpleasant		No Comment			
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Peroxide	88	6	6.8	3	3.4	8	9.0	40	45.5	40	45.5	6	6.8
Perborate	93	6	6.4	0	0.0	2	2.2	53	56.9	38	40.9	20	21.1

TABLE 2.—DATA ON USE OF TOBACCO AND ALCOHOL

Dentifrice Used	Total No. of Subjects	Smoking						Alcohol					
		None		Light		Heavy		None		Light		Heavy	
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Peroxide	88	34	38.7	34	38.7	20	22.6	71	80.7	16	18.2	1	1.1
Perborate	93	37	39.6	33	35.5	23	24.9	79	84.9	13	14.0	1	1.1

TABLE 3.—EVALUATION OF ALL FACTORS IN EXPERIMENT

Dentifrice Used	Total No. of Subjects	Tongue Changes				Mouth Discomfort	No Comments	Smoking			Alcohol		
		Total No.	Gastro-intestinal Upset, Cold, Etc.	Effective Tongues				None	Light	Heavy	None	Light	Heavy
				Number	Per Cent								
Peroxide	33	5	1	4	12.1	4	0	2	2	0	2	2	0
Perborate	38	9	2	7	18.4	4	3	3	3	1	7	0	0
Peroxide followed by perborate	22	2	1	1	4.5	0	1	3	2	1	5	1	0
		6	1	5	22.7	3	2						
Perborate followed by peroxide	33	9	1	8	24.2	4	4	3	4	2	8	1	0
		2	1	1	3.0	1	0						

gival condition (color index of the marginal gingiva, cemental gingiva, and areolar mucosa), the tongue changes (regions involved, appearance and subjective symptoms), condition of other tissues and, finally, miscellaneous observations. A photograph of the tongue and gingival tissues of each subject was taken at the outset, during and at the termination of the experiment.

Each subject was instructed to use specified dilutions two to three times daily both as a dentifrice (solution to be used as a toothbrush dip) and as a mouthwash. The periods of time elapsing in the investigation varied from approximately one month to two and one-half months with each of the materials used. The concentration of the hydrogen peroxide solution ranged from 3:50 to 1:8 with tap water, and the sodium perborate was used in dilutions ranging from 3:250 to 3:25 with tap water.

Evaluation of clinical experimental statistical material: Table 1 indicates the results from the use of hydrogen peroxide and sodium perborate in the group of subjects under consideration. It is interesting to note (Fig. 4) that although changes in the gingival tissues indicated a similar percentage of change toward "redder" from the use of both materials (6.4-6.8 per cent), pallor of the gingivae occurred in 3.4 per cent of the cases using hydrogen peroxide, with none reported in the sodium perborate series. The reported subjective symptomatology in using the dentifrices (Fig. 5) shows a definite tendency toward greater unpleasantness in using the perborate preparation. This fact should be kept in mind in evaluating the really significant differences shown under the heading of "effective tongue changes." The term "effective tongue change" is used to indicate the pathologic changes in the tongue which can reasonably be assumed to be due to the dentifrices used. Table 2 shows how tongue changes due to other conditions were excluded.

Hypertrophy of the filiform papillae occurred in six subjects, or 6.8 per cent, of the eighty-eight using hydrogen peroxide, and in twenty subjects, or 21.1 per cent, of the ninety-three using sodium perborate (Fig. 6). This percentage difference in the parallel groups is worthy of consideration.

Two common causes of tongue changes (pseudotypes) are the use of tobacco and alcohol. The final tabulation of the results relative to these facts is given in Table 2 and illustrated in Figures 7 and 8. Concerning smoking, the indulgence

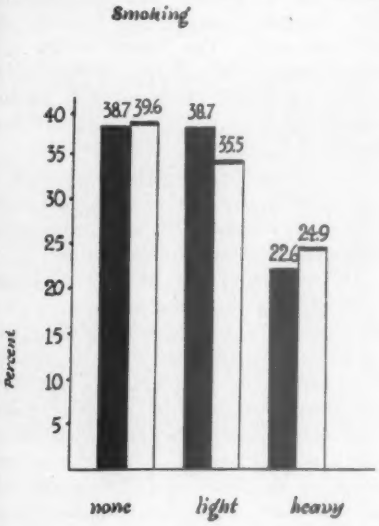

Fig. 7.—Percentage evaluation of smoking among experimental subjects using hydrogen peroxide (black column) and sodium perborate (white column).

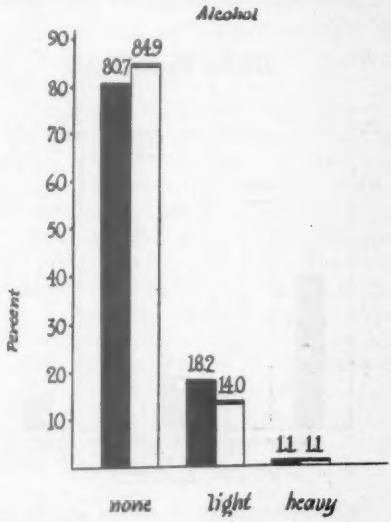

Fig. 8.—Percentage evaluation of use of alcohol by experimental subjects using hydrogen peroxide (black column) and sodium perborate (white column).

in a greater number than fifteen cigarets or their equivalent per day was taken as "heavy," anything less, listed as "light." In a similar fashion, regular indulgence in alcoholic drinks was indicated as "heavy," while occasional mild indulgence is found under "light."

The figures indicate so close an agreement in all categories as to warrant the consideration of smoking and alcohol as only secondary factors in tongue pathosis. The widest percentage difference, 4.2, occurred in the groups who used no alcohol, and those who came under the listing of "light." No significant tendency is manifested by either group.

Table 3 indicates the procedure used in eliminating from consideration those tongues in which there may have been other etiologic factors in the change. The number of subjects who gave a history of a concomitant cold or gastrointestinal upset, etc., during the experiment and reported a tongue change were subtracted from the total reported in giving the group of so-called "effective tongue changes." The effective tongue changes were held to be due most probably to the use of a certain dentifrice, and these alone were included in Table 1.

In Table 3, the groups of subjects used the materials under consideration in two ways. Two groups used only the hydrogen peroxide or the sodium per-

borate for the duration of the experiment, whereas the remaining two groups used first one material for a period of time and then the other material. The distribution of smoking and alcohol in this smaller group, considering only cases of "effective tongue changes," is in general agreement with the distribution in the entire group (Table 2). Figure 9 indicates a considerably greater incidence of tongue changes in these smaller groups in the perborate group. When the perborate was used alone, or after a period of peroxide use, or before a period of peroxide use, significant differences occurred.

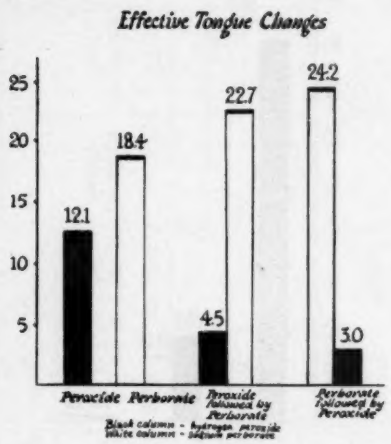

Fig. 9.—Percentage evaluation of effective tongue changes by smaller groups.

*Pathologic Examination of Lingua Filaceosa Chromatica.**—The validity of the contention that the fundamental process being dealt with is one of hyperkeratinization of the filiform papillae of the tongue is substantiated by the pathologic examination of two cases of hairy tongue. Biopsies were made in two typical cases of such tongue alteration, the tissue being taken from the lesion anterior to the circumvallate papillae. Clinically, the first tongue appeared grayish green, whereas the second was brownish black.

In the first case, that of a man aged 61 (Fig. 10), the complete tissue biopsy showed, in section, three or four filiform papillae, cut almost axially. In each (Figs. 11 and 12), a central stalk of connective tissue was capped with conical desquamating masses of epithelium. This desquamation was highly uneven, being thick in some fields and thin in others. Some areas showed the desquamating cells forming pseudoplugs between the filiform stalks. The tissues of the stalk were flecked with chronic inflammatory cells. Evidence of congestion of the vessels in the stalk appeared in some fields.

A diagnosis of hyperkeratinization of the filiform papillae with a reaction to injury (irritation) in the supporting stalks was made from this section.

In the second case, that of a woman, aged 20 (Fig. 13), the biopsy tissue was sectioned at right angles to the long axes of the filiform papillae (Figs. 14 and 15). The islands of desquamating epithelial tissue represent the tips of the papillae. The tissues of the central stalk which carry serving vessels appeared as oval windows in these epithelial masses. In several fields, these masses appeared actually conjoined and bound together by the desquamating cells. Purple staining plaques (débris and other irritants) were found free or adhering to these epithelial masses.

A diagnosis of hyperkeratotic filiform papillae was made from this section.

Mycologic Examination of Lingual Filaceosa Chromatica.†—A consideration, earlier in this paper, of the etiology of *lingua filaceosa chromatica* indicated the

*Tissue sections were examined and described by Charles G. Darlington, M.D., and Gregory N. Brown, M.D., Department of Pathology, New York University College of Dentistry.

†Direct microscopic and cultural mycologic examinations were made by Norma C. Styron, B.S., M.S., Department of Bacteriology, New York University College of Medicine.

need for investigation of the rôle played by fungi in this pathologic process. Twenty-two clinic patients presenting this tongue lesion were chosen at random and examined for the presence of associated fungi.

Procedure: A history was taken in each case for information pertaining to the dentifrice and mouthwash used, the dosage ordinarily employed and the period of use. Marked difficulty was almost uniformly experienced in obtaining information on the date of onset or the duration of the tongue aberration. Subjective symptoms were rare. The extent of the lesion was indicated on the tongue map

Fig. 10.—Lingua filaceosa chromatica in a man, aged 61, following use of sodium perborate, 1 teaspoonful to glass of water every hour for two weeks.

(Fig. 3) and a description of its color and the approximate length of the hypertrophied portion was recorded. Other common causes, such as gastrointestinal disturbances, heavy smoking and the use of alcohol, were ruled out.

The tip of the patient's tongue was firmly grasped with gauze and drawn out of the oral cavity. The surface of the tongue was then dried with sterile gauze. A sterile curet was employed in scraping a typical portion of the lesion. The surface débris was avoided as far as possible, the effort being to collect the material from the base of the hypertrophied papillae.

The specimens were then studied in two ways: 1. By direct microscopic examination for the presence of yeastlike fungi. This procedure involved the use of a wet preparation, with the tissue cells dissolved in 20 per cent potassium hydroxide. 2. By cultural examination for the presence of yeastlike fungi. The material was inoculated on the surface of malt agar and Sabouraud's medium and incubated for a period of four weeks at room temperature.

Findings in mycologic examination: A condensation of the findings (Table 4) clearly shows a number of interesting facts. The twenty-two clinic patients chosen at random and showing "hairy tongue" included a relatively large number who were using various saline dentifrices. It should be borne in mind that this is due to the high proportion of patients who have such dentifrices prescribed therapeutically for other purposes and is no indication of the nature of the material used for a variable period of time previous to the tongue examination The group recorded as "miscellaneous" included those using a wide variation of non-specific commercial pastes, powders and mouthwashes.

The direct microscopic examination for the presence of yeastlike fungi was positive in only two of the twenty-two cases, or 9.1 per cent, and the cultural examination for yeastlike fungi in the same series of patients was positive in only six instances, or 27.3 per cent. The limited number of cases considered does not warrant an absolute conclusion. It is doubtful whether these percentages of positive findings are significant. The presence of fungus-like yeast cells in the oral cavity is not in itself a pathologic finding, and the interstices of the mat-

ting in tongues with hyperkeratinized filiform papillae present areas well adapted to the protection, growth and cultivation of such micro-organisms. The likelihood of their presence as an occasional concomitant finding rather than an etiologic factor should be considered. A similar series of negative control experiments were not made.

The non-specificity of the tongue color changes occurring with the various dentifrices used in this group of cases is indicated in Table 5.

*Rat Experimentation with Sodium Perborate and Hydrogen Peroxide.**—Eight rats were divided into four groups and tested with the two materials as follows: Group 1, 2 per cent sodium per-

TABLE 4.—INCIDENCE OF YEASTLIKE FUNGI IN TWENTY-TWO CASES OF LINGUA FILACEOSA CHROMATICA

Dentifrice in Use	Number of Cases	Direct Microscopic Examination for the Presence of Yeastlike Fungi		Cultural Examination for the Presence of Yeastlike Fungi	
		Number Positive	Number Negative	Number Positive	Number Negative
Sodium perborate preparations	6	1	5	1	5
Saline dentifrices	6	1	5	3	3
Hydrogen peroxide	1	0	1	0	1
Miscellaneous	7	0	7	1	6
No dentifrice	2	0	2	1	1
Total	22	2 (9.1 per cent)	20 (90.9 per cent)	6 (27.3 per cent)	16 (72.7 per cent)

TABLE 5.—COLOR VARIATION IN CASES OF LINGUA FILACEOSA CHROMATICA IN WHICH MYCOLOGIC EXAMINATIONS WERE MADE

Dentifrice in Use	Color						Total
	Gray	Gray-Green	Yellow	Light Brown	Brown	Brown-Black	
Perborate preparations	3	0	1	1	0	1	6
Saline dentifrices	3	2	1	0	0	0	6
Hydrogen peroxide	0	0	0	0	1	0	1
Miscellaneous	5	1	0	1	0	0	7
No dentifrice	0	0	0	2	0	0	2
Total	11	3	2	4	1	1	22

*This experiment was performed by Isaac Neuwirth, Ph.D., associate professor in the Department of Pharmacology and Therapeutics, New York University College of Dentistry.

borate in tap water (approximately 42.5° C.); Group 2, 4 per cent sodium perborate in tap water (approximately 42.5° C.); Group 3, 50 per cent hydrogen peroxide, and Group 4, tap water.

For a period of six weeks, the tongue and cheeks of each of the rats were thoroughly swabbed with the given solution twice daily. At the end of this period, one rat in each series was killed and the mouth examined for clinical abnormalities. Neither hypertrophy of the filiform papillae of their tongues nor changes of the buccal membranes were noted in any instance.

The remaining rat in each group was then subjected to a similar swabbing with sodium perborate paste three times daily for seven weeks. At the end of this period, the rats were killed and their mouths examined. Again, none showed any clinical oral abnormality.

Fig. 11.—Axial section of tissue in lingua filaceosa chromatica. (Low power.)

All the rats used in this work were mature (5 months of age) when entered in the experiment. They were kept on normal stock rations and grew normally throughout.

The advantages of animal experimentation, permitting rigid control and closer observation, are self-evident. The random choice of the rat as the experimental animal opens the question of its susceptibility or relative immunity to the production of tongue changes with the materials used.

pH of Solutions of Sodium Perborate and Hydrogen Peroxide and the Buffering Action of Saliva.—General considerations: The pH of saliva is a variable quantity, depending on individual differences, diurnal variations, the ingestion of food, procedures which stimulate the flow of saliva, etc. Colorimetric methods are ordinarily employed in such determinations since the more precise results possible with the electrometric methods, using the glass electrode, H-electrode or quinhydrone electrode, entail considerable difficulties. The latter are fairly accurate to 0.05 pH, whereas the colorimetric methods, as with indicators, should not be relied on beyond a 0.2 pH unit.

Resting saliva, obtained without chemical or physical stimulation, was determined colorimetrically by Starr[20] as averaging pH 6.6 in a range between pH 5.75 and 7.05 in normal individuals on an average diet. The H-electrode method was adapted by Hermann[21] to salivary pH analysis, and an average value of pH 6.63 was found. More re-

cent investigations by Soyenkoff and Hinck,[22] using a glass electrode, and with temperature and chemical changes reduced to a minimum, found values ranging between pH 6.40 and 6.88. Their data also substantiate the work of Starr that muscular exercise of the jaws, as in chewing a piece of paraffin, makes the saliva more alkaline by 0.1-0.8 pH unit. Morning and afternoon saliva show no definite difference in reaction.[23]

The buffer action of saliva is primarily dependent on the concentration of phosphates, and of carbon dioxide and its salts. Any physical disturbance of the saliva will tend to cause a loss of carbon dioxide and make the material more alkaline. Drifts in pH also occur in saliva on standing. The lower protein content of saliva in comparison with blood makes it correspondingly weaker as a buffer. Paraffin stimulated saliva tends to be supersaturated with carbon dioxide owing to the excessive mouth mixing.

The preceding factors are of significance in consideration of the pH determination of solutions of varying concentrations of sodium perborate and hydrogen peroxide, and the buffering effect which saliva has on them.

Procedure followed: Two basic colorimetric indicator technics were used,† all the usual precautions being taken:

1. Paraffin stimulated saliva was collected and its pH determined. The pH of a given concentration of the sodium perborate or hydrogen peroxide solution was obtained. Small quantities of the saliva were then added to the solution being tested and the changes in pH noted. This part of the experiment was performed, therefore, completely *in vitro*.

2. In order to obtain information on the actual reaction changes occurring in the mouth when the solution of sodium perborate or hydrogen peroxide is used as a mouthwash, the original pH of the saliva, the original pH of the solution and the changes on vigorous mixing in the mouth were necessary. A simple funnel device with rubber tube and glass delivery tube (Fig. 16), developed by Soyenkoff, was employed for collecting material from the mouth, since only minimum carbon dioxide changes then occur. The funnel is placed in the mouth

Fig. 12.—Axial section of tissue in lingua filaceosa chromatica. (High power.)

†The determinations were carried out with the cooperation of Claus F. Hinck, Jr., Ph.D., professor of chemistry, New York University College of Dentistry, and two members of his department, Basil C. Soyenkoff, Ph.D., and Otto R. Trautz, Ph.D., assistant professors.

between the lips and the teeth (Fig. 17) and the material transferred to a test tube with the least possible shaking or jarring. The indicator is then added and mixed with minimum disturbance by a specially shaped stirring rod. This procedure is an attempt at *in vivo* pH changes, with actual conditions of use simulated.

Because of the relatively wide range of pH covered, four standard indicators were employed: bromthymol blue, range

Fig. 13.—Lingua filaceosa chromatica in a woman, aged 20, following use of sodium perborate, 1 tablespoonful to one-half glass of water, every hour for eight days.

pH 6.0 to 7.6; phenol red, range pH 6.8 to 8.4; thymol blue, range pH 8.0 to 9.6; LaMotte purple, range pH 9.6 to 11.2.

FINDINGS WITH HYDROGEN PEROXIDE*

Part 1.—Solutions varying from 2:125 hydrogen peroxide and distilled water up to undiluted commercial hydrogen peroxide (3 per cent) were tested for pH changes by the addition of collected saliva of known pH. The original pH of the solutions was slightly on the acid side, ranging from 6.0 to 6.3. The addition of small quantities of saliva rapidly buffered the acidity of the hydrogen peroxide in the weaker solutions tested, but was somewhat less effective with the more concentrated solutions. The reaction tends to become that of the saliva and close to neutrality (pH 7.0) with the addition of equivalent quantities of saliva. This tendency increased with the greater dilution of the hydrogen peroxide solutions.

Part 2.—Solutions of hydrogen peroxide and distilled water ranging from 2:125 up to undiluted hydrogen peroxide (3 per cent market preparation) were tested for pH changes induced by mixing with the saliva in the mouth for periods from two to sixty seconds. The weaker concentrations of the hydrogen peroxide solutions were rapidly buffered to the pH of the saliva (pH 6.6-6.8), whereas the stronger solutions closely approximated this reaction, reaching pH 6.6 in one minute.

FINDINGS WITH SODIUM PERBORATE

Part 1.—Solutions ranging from 1:500 to 1:25 of sodium perborate and distilled water were tested for pH changes induced by the addition of collected saliva of known pH. The original pH of the solutions was high on the alkaline side (pH 9.3-9.9). Additions of progressively larger quantities of saliva produced only slight changes in the reaction. The pH was brought to 9.1 in the case of the weakest solution and to 9.5 with the strongest solution by the addition of equivalent quantities of saliva.

Part 2.—Solutions ranging from 1:500 to 1:25 of sodium perborate and distilled water were tested for pH changes on mixing in the mouth for periods of time

*Detailed information on the actual pH changes with hydrogen peroxide and sodium perborate may be obtained from the authors on request.

from two to sixty seconds. The immediate pH change on taking the solutions into the mouth was negligible. The weakest solution tested gave a reaction of pH 8.8 after one minute, whereas the strongest solution remained strongly alkaline (pH 9.3) in the same period of time.

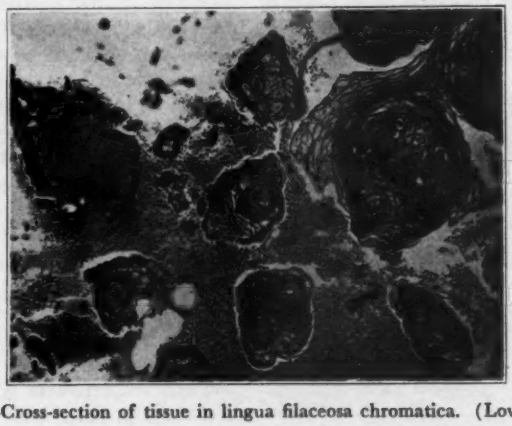

Fig. 14.—Cross-section of tissue in lingua filaceosa chromatica. (Low power.)

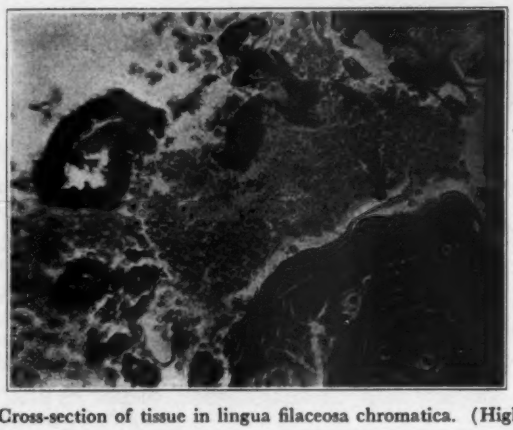

Fig. 15.—Cross-section of tissue in lingua filaceosa chromatica. (High power.)

The relatively strong alkaline nature of the sodium perborate solutions and the weak buffering effect of the saliva on these solutions, as shown in the preceding investigations, led to further study of the possible effect of the addition of sodium bicarbonate to sodium perborate solutions as has been advised in the past.[24]

The addition of 1 part sodium bicarbonate to 2 parts sodium perborate has been recommended to reduce the high pH of sodium perborate in therapeutic use. The experiments performed with sodium perborate were repeated with this sodium perborate-sodium bicarbonate mixture.

Part 3.—Solutions ranging from 1:500 to 1:25 of the sodium perborate and sodium bicarbonate combination with

distilled water were tested for pH changes by the addition of collected saliva of known pH. The pH of the modified solutions differed only slightly from the pure sodium perborate mixture. The reaction of the original solutions was depressed between 0.2 and 0.6 pH units, but still remained high in the alkaline range (pH 9.1-9.3). The buffering effect of the saliva also was poor, the reaction of the solution being altered but 0.2 pH unit by the addition of equivalent quantities of saliva.

Part 4.—Solutions ranging from 1 : 500 to 1 : 25 of the sodium perborate-sodium bicarbonate combination in distilled water were tested for pH changes produced by mixing in the mouth for periods ranging from two to sixty seconds. The original reaction of pH 9.1-9.3 was found to be depressed to pH 8.6-9.1 after vigorous mixing in the mouth for the extreme limit of one minute.

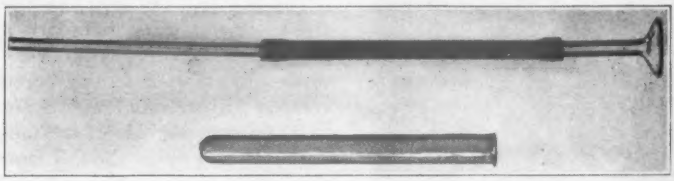

Fig. 16.—Funnel device used for transferring fluid from mouth to test tube.

EVALUATION OF pH FINDINGS

The slightly acid nature of hydrogen peroxide tends to make the buffering effect of the saliva more marked, since it need operate in only a narrow range. The considerable alkalinity of the solutions of sodium perborate is affected by saliva both in the test tube and in the mouth to only a very limited degree, and tends to remain strongly basic even with the addition of sodium bicarbonate.

The conclusion should not be drawn from these determinations that the alkalinity of the sodium perborate solutions is the fundamental irritating factor in tongue changes. Only further clinical and experimental data will be able to answer that question. The disadvantages of a strongly alkaline mouthwash are to a large extent dependent on failure to give necessary directions for therapeutic use, such as need for proper dilution, rinsing the mouth after use and the limited period of use.

SYSTEMIC EFFECT OF USE OF SODIUM PERBORATE AS A MOUTHWASH AND DENTIFRICE

The possibility of systemic poisoning from the too frequent or too abundant use of sodium perborate should not be overlooked by the physician and the dentist. The effects are probably those of boron poisoning through ingestion or absorption of the material while it is being used as a mouthwash, gargle or dentifrice. The following case from the practice of L. B. Winkelstein, M.D., is illustrative. Milder cases are no doubt more frequent, but may not be attributed to this factor.

REPORT OF CASE

History.—A man, aged 35, first seen January 4, 1935, complained of pain in the midepigastrium, pronounced flatus, severe constipation, anorexia and pain in the extremities. The past history was essentially negative except for a Vincent's infection which had proved resistant to treatment for a year. The patient had been instructed to use sodium perborate in large quantities, advice which he followed assiduously for four weeks. He was using a solution of 8 teaspoonfuls to half a glass of water at frequent

intervals during the day and, in accordance with instructions, also rubbed the dry powder on the gums and tongue. Symptoms developed from seven to ten days after this régime was begun.

According to the history, past examination had revealed the Vincent's infection; head, eyes, nose, cardiorespiratory and neuromuscular systems negative; gastrointestinal system negative except for mucus and bile in the stool, which were absent before the onset of the present condition; genito-urinary system negative except for polyuria for the past two weeks; habits normal.

Examination.—The patient was well developed. The eyes and ears were negative.

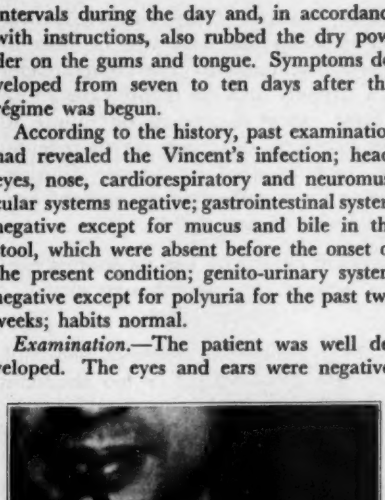

Fig. 17.—Funnel placed between lips and teeth. The fluid is allowed to flow into a test tube.

The mucous membranes of the nose were slightly congested. The gums were inflamed and covered with a white membrane that could be scraped off easily. The tongue surface showed the hypertrophied papillae of *lingua filaceosa chromatica.* Mouth smears showed Vincent's organisms. The cardiorespiratory system was negative, with pulse 82 and blood pressure 125 systolic and 75 diastolic. Examination of the abdomen, urinalysis and Wassermann test were negative. The reflexes were slightly sluggish. The hemoglobin index was 80. The temperature was 98. Rectal examination revealed small hemorrhoids.

Diagnosis.—Intoxication, possibly from boron poisoning, was diagnosed.

Treatment and Outcome.—Fluids in considerable amounts were prescribed, with discontinuance of the sodium perborate and the institution of hydrogen peroxide as a mouthwash. All unfavorable symptoms disappeared within eleven days.

SUMMARY AND CONCLUSIONS

1. The use of the term *lingua filaceosa chromatica* (colored filamentous tongue) is recommended to replace such terms as black tongue, black hairy tongue and hairy tongue.

2. A controlled clinical study of the oral use of sodium perborate and hydrogen peroxide with 181 subjects indicated that under the given conditions:

(a) Six (6.8 per cent) of the eighty-eight subjects using hydrogen peroxide and twenty (21.1 per cent) of the ninety-three subjects using sodium perborate developed hypertrophied (hyperkeratinized) filiform papillae of the tongue.

(b) Both groups showed similar gingival changes to a deeper red with the use of these substances (6.4 per cent with hydrogen peroxide and 6.8 per cent with sodium perborate), but 3.4 per cent reported "paler" gingivae with hydrogen peroxide, whereas none indicated such a change with sodium perborate.

(c) Other causes for tongue changes, such as smoking and the use of alcohol, were very similar in the two groups, and were eliminated in the evaluation of the experimental findings.

3. Pathologic examination of two cases of *lingua filaceosa chromatica* substantiated the clinical diagnosis of hyperkeratinization of the filiform papillae.

4. Mycologic examination of twenty-two cases of *lingua filaceosa chromatica* showed negative results in 90.9 per cent on direct microscopic examination for yeastlike fungi, and negative results in

72.7 per cent on cultural examination for the presence of fungi. The low percentage of positive findings casts doubt on the rôle of fungi as etiologic agents in this type of tongue pathosis.

5. Eight rats tested orally with sodium perborate and hydrogen peroxide gave consistent negative results (no pathologic changes occurred). The susceptibility or immunity of these experimental animals to the materials is not known.

6. The pH of solutions of various concentrations of hydrogen peroxide varied between 6.0 and 6.3. They were rapidly buffered by the addition of saliva *in vitro* or by mixing in the mouth *(in vivo)*.

7. The pH of solutions of various concentrations of sodium perborate varied between 9.3 and 9.9. They were slowly but incompletely buffered by saliva to a maximum of 0.6 pH unit.

8. The pH of solutions of various concentrations of sodium perborate and sodium bicarbonate in the proportion of 2:1 was found to be reduced to 9.1-9.3. The buffer action of saliva both *in vitro* and *in vivo* was still slight.

9. The possible causation of oral pathosis by the use of these substances indicates the need for their use only under supervision as specific therapeutic agents, with definite instructions to the patient as to concentration to be used, frequency and method of use, and the need for rinsing the mouth with water after the solutions touch the oral tissues.

10. Systemic effects are possible from the excessive use of sodium perborate.

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A SYSTEM OF CAVITY PREPARATION AND WAX MANIPULATION FOR THE CAST GOLD INLAY

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THE technical advances made during the last decade in the field of the cast gold inlay have been almost unbelievable. As a result, a feeling of self-satisfaction prevails among inlay workers, and this important branch of operative dentistry has been neglected by essayists and clinicians alike for the last year or two. F. S. Meyer[1] has issued a challenge, and we will all agree with him when he states, "No casting in gold has ever been made, is being made, or will be made, to the accurate dimensions of a wax pattern." The last phrase "of a wax pattern" is particularly significant and will be considered later.

Cavity preparation is the foundation of inlay technic and it must be based on biologic as well as mechanical principles,[2] for we are dealing with vital tissues involving both health and disease. The next important step is the securing of a wax pattern that is dimensionally accurate and anatomically and biologically correct. These are the two phases of inlay work with which this paper deals.

BIOLOGIC CONSIDERATIONS IN CAVITY PREPARATION

The health of the pulp must be protected during operative procedures and be conserved, if possible, during the lifetime of the patient. This also holds true for the supporting structures of the tooth. To assure this end-result, every effort must be made during cavity excavation to minimize frictional heat and other forms of irritation and reduce trauma. Sharp-cutting burs are employed in a dry field under a blast of warm air and are not used with excessive motor speeds. Handpieces or contra-angles that are so worn that burs or stones do not run true are not used by the careful operator. Abrasives such as stones or disks must run true and have efficient cutting surfaces kept moistened with tepid water.

Drug and chemical irritation must also be avoided during operating, and every means available must be used to protect the pulp from subsequent thermal shock as well as from recurrence of caries or electrical irritation during the lifetime of the inlay. Other biologic factors will be discussed by Dr. Williams, who will describe the final seating and finishing of the inlay.

MECHANICAL PHASE OF CAVITY PREPARATION

There are three basic systems of cavity preparation for the cast gold inlay. The first system, as used by Taggart, in 1907,[3] was based on the cavity prepared for gold foil. Walls were made parallel and placed at right angles to the floor, and cavities were frequently prepared with too great a loss of tooth substance. These first inlays were generally made of 24-carat gold, with the direct technic, and bulk seemed necessary. Accuracy of fit was difficult to secure because many variables were

The papers of Drs. Brown, Nylander (page 1982) and Williams (page 1986) were presented as a Symposium on Cast Gold Inlays before the Section on Operative and Preventive Dentistry at the Seventy-Fourth Annual Midwinter Clinic of the Chicago Dental Society, February 16, 1938.

present, although they were not recognized, and many an inlay was "an island of gold in a sea of cement." This can be called the parallel-wall type of preparation, even though the walls had a 5 per cent taper per inch in order to appear parallel to the eye and allow the withdrawal of a wax pattern without distortion.

In 1908-1909, M. L. Ward[4] found that cavities prepared with a taper of from 8 to 20 per cent per inch, the larger taper being used on teeth the crowns of which were long from the cervical portion to the occlusal surface, could be fitted with inlays with greater ease than the so-called parallel-wall type. This gave rise to the so-called hopper or taper type of cavity, which was used mainly with the direct technic; for this preparation, in many cases, did not remove the convexity of the proximal surfaces, although it partially compensated for some variables that the parallel-wall type of cavity did not.

An American dentist in Berlin, H. W. C. Bodecker,[5] in 1909 developed the first so-called slice type of inlay preparation. This preparation removed the convexity of the tooth on the proximal surface by the use of lightning or other forms of disks, such as the vulcarbo types, and gave a finishing facet or bevel below the cervical floor, thus paving the way for an accurate indirect technic. Dr. Bodecker also used a type of preparation that was certainly the predecessor of the "channel slice" type. The slice type of preparation, peculiarly adapted to the indirect technic, was not utilized in this country until a decade later, when some of the better inlay workers saw its possibilities and developed a system of cavity preparation based on it, although W. C. Gowan,[6] of Canada, described a similar type in 1912. Rhein and Gillett were the first to advocate its use, although other operators were using the Black and Ward types with modifications for the indirect technic.

However, there is no one system of cavity preparation. The type of cavity to be prepared is chosen with a view to the case in hand. The slice type of preparation is not indicated for short, extremely bell-crowned teeth, nor will they stand prepared cavities with excessive tapers; for example, from 10 to 20 per cent per inch. W. L. Wylie[7] has discussed the slice versus the box type of preparation, and both have merit. However, we must remember that there is a systematic procedure that should be followed in every cavity preparation, based on the procedure given us by G. V. Black[8] and utilizing a combination of both the taper and the slice preparation.

I believe that the slice type of preparation with its different variations, using a correct taper for cavity walls, plus the use of the indirect technic to produce an accurate casting, will give the poor, mediocre and average operator an equal chance with the highly skilled operator, who may use the direct technic with excellent results.[9] This paper is based on the indirect system of inlay work because I believe it to be the system most nearly universal in application and most easily mastered by the average operator.

In the preparation of a Class II, or two-surface, inlay cavity, it is assumed that the operator has made roentgenograms of the tooth to be prepared. Often, we prepare Class II inlay cavities where Class VI or mesioclusodistal cavities should be prepared.

A rubber dam may be applied at this point if the slice type of preparation is not used. If we intend to slice the proximal surface, however, a preliminary slice must be made with a suitable disk to remove the surface convexity before the rubber dam is placed in position.

The first step is to gain access to the cavity. If there is extensive caries on the proximal surface, with the marginal ridge badly undermined or broken away, chisels will cleave the enamel and secure access so that the extent of the decay can

be ascertained. If the caries has not reached this stage or has merely entered the dentin, a preliminary slice is made, using lightning or safe-sided disks kept moistened with tepid water. These disks are started on the marginal ridge from 0.5 to 1.0 mm. toward the central fossae from the margin, and a slice made that emerges at the crest of the gingivae. The operator must guard against removal of enamel from the proximating tooth by the disks, for this invites caries. The rubber dam can be placed in position and the extent of caries on the proximal surface readily observed. It is not difficult to develop a proximal box after this slice is made, as a No. 701-702 fissure bur will readily cut through the little enamel that remains and the box can be prepared with its extensions determined by the extent of caries penetration. The occlusal portion is prepared, inverted cone burs being used to remove amalgam or any other filling material that may be present, or small knife-edge stones and inverted-cone burs may be used to open up grooves on the enamel if the surface has not been filled.

The cavosurface margins are outlined mentally and should receive careful consideration; for if the work is done in a haphazard manner, we abuse the theory of extension for prevention. It is true that many inlays fail because cavities have been made too shallow, both on the occlusal and on the proximal surfaces, but it is also true that cavities have been extended buccally and lingually toward the axial angles a great deal farther than removal of decay or extension for prevention demands.

Many cavities need only minimum extension in these directions, especially in clean, well-kept mouths. The operator should estimate the liability to caries on the proximal surfaces and remember that healthy gum tissue should cover the cervical or gingival margins of the inlay, except in cases of extreme gingival recession or in aged patients.

Embrasures that open or flare from the contact points to the axial angles call for the minimum of extension buccally or lingually, and the restoration can be made to give self-cleansing margins by making the contours of the inlay more convex than those of the tooth. The occlusal portion with its dovetail may be cut deep and narrow or wide and shallow, this depending on the cusp height and the bite of the patient. All grooves must be crossed at right angles or be included in the preparation. With the preparation of a well-defined dovetail on the occlusal surface, the outline form is complete.

At this point, any remaining caries is removed. Large round burs and spoon excavators are used to remove all traces of caries without endangering the pulp, especial attention being given to dentinoenamel junctions and under cusps. This step is most important, and if a pulp exposure must result in order to remove softened dentin, the exposure must be made. In many cases, it is possible to allow hard or stained leathery dentin to remain over the pulp. However, the quick reduction method for the precipitation of silver nitrate should be used to sterilize this infected tissue.

Resistance and retention forms, two distinct requirements, are secured by the same operations in cavity preparation. Flat occlusal and cervical floors, good occlusal anchorage through dovetailing and adequate bulk for the case under consideration are essential. The channel slice may be used if it is deemed necessary to secure additional resistance and retention, especially in short-crowned teeth that are markedly convex.

The walls are prepared and finished with tapered stones and burs, which are generally made with a taper of 8 per cent. Since the proximal surface has been sliced, tapered walls are naturally present, and convenience form in the withdrawal of the impression from the cavity is satisfactorily provided, for no under-

cuts will exist. The cement base, if present, is treated as if it were tooth substance, and any part of the cavity is prepared in the cement, if necessary. No cement is allowed to remain near the cavosurface margins, for this invites disaster at these vulnerable areas.

A cement base is indicated in most cavities that have shown any large amount of carious involvement in the proximal or on the occlusal surface, or both, or in those cases in which old amalgam fillings have been removed. Let us bear in mind that the utilization of a cement base will serve several purposes, all of which are biologically important:

1. It will remove undercuts and give better convenience form in withdrawal of the compound impression or wax pattern.

2. It will insulate the pulp against thermal or electrical irritations. The Bureau of Standards has shown that a temperature rise of 27 degrees F. will occur in five seconds in a mouth containing a gold inlay resting directly on the dentin of a tooth. If one-sixteenth inch of cement is interposed between the dentin and the inlay, it will take thirty-five seconds, or seven times as long, for this same temperature rise (27 degrees). Furthermore, a one-eighth inch layer of cement will increase the length of time necessary eighteen times. This should be conclusive proof that all deep cavities should be lined with cement, no matter what filling material is to be used.

3. It will lessen the amount of filling material to be used. This reduces the chance for thermal shock and is an economy to the dentist, which is of some importance when gold is used.

The cement used for basing should meet the American Dental Association specifications. Employment of a heavy, thick mix will cause less acid irritation to the dentin, with its probable sequelae. It is well to use a cavity varnish before applying the cement base. I have found satisfactory the varnish recommended in the 1937 edition of "Accepted Dental Remedies," composed of a chloroform solution of gum copal 2 per cent.

The cavity preparation having been completed, all that remains is the finishing of the enamel walls. This is accomplished by means of suitable stones. The cavity should show a smooth surface in the form of arcs or segments of a circle along the occlusal walls, with no cement approaching the cavosurface margin. The cervical floor may rest on cement in a slice type of cavity, but the cervical facet must be of sound tooth substance and extend gingivally at least 1 mm. beyond this cervical floor of cement. However, it is safer to have the floor resting on sound tooth substance. The proximal slice is polished with fine emery and sandpaper disks for a final finish.

The angle formed by the junction of the pulpal floor and axial wall should be beveled, as this prevents concentration of stress at this point and obviates errors in casting, for a sharp angle of investment will fracture when it encounters molten gold. The occlusal cavosurface margins should be beveled one-third the length of the enamel rods, as this facilitates spinning the gold in finishing the inlay and also gives added protection to the enamel rods against fracture during mastication.

The cavity is now ready for a modeling compound or wax impression. The slice type of preparation is not amenable to the direct technic, as some margins are too delicate to permit accurate carving and burnishing of the wax in the proximal and cervical areas *in situ* in the mouth. The next step in the direct technic is to secure the wax pattern. Consideration of the manipulation of inlay waxes will cover this subject.

The indirect technic requires an impression of the cavity, taken in either modeling compound or a hard inlay wax. A copper band (30 gage) is fitted to the cavity so that it passes below the cervical floor on the proximal surface. The band is cut so that it does not go below the bulge on the buccal or lingual surfaces,

thus avoiding compound or wax being confined under the bulge, which may interfere with the removal of the impression and possibly cause distortion. The copper band should be carefully fitted and should be made so that a slight excess of compound will pass around all cavity margins.

With three-surface inlays, the band is heated and compound is seared over the cervical margins, uniting the compound and the band at these points, which prevents the compound from being pushed away from the band when the impression is taken. Properly softened compound is placed in the band, the compound and band are placed in hot water (150° F.) and the band is placed in position over the tooth, all saliva, débris and blood having been removed. Then pressure is put on the compound to drive it into all parts of the cavity. It is not necessary to lubricate the cavity. The band and compound are held under pressure until the compound reaches mouth temperature and hardens. It is not chilled with cold water or air. The impression is then removed. It should come off the tooth without any great amount of force, as otherwise distortion will occur. An impression that has to be removed with forceps is worthless.

In two-surface inlays, the band is correctly contoured and placed in position on the tooth. Then, a compound cone is heated over the flame to soften the outer surface, dipped into hot water (150° F.) and placed in the cavity under pressure. The hard inner cone of the compound acts as a plunger and forces the softened compound to all parts of the cavity. The compound is allowed to harden and is then removed. Impressions are carefully examined with a glass, and if any imperfections are present, a new impression is taken.

A type of soft wax can be melted and painted on the inner surfaces of impressions with a badger brush and the impression replaced, if it is deemed necessary to remove minor imperfections. This procedure is similar to Van Horn's wax-tray technic. The impression is now made by depositing copper on its inner surface by electrolysis, and the model or die finished by strengthening the copper plating with stone or low-fusing metal. This method gives an exact replica of the cavity and is far superior to making an amalgam model.

WAX MANIPULATION

This paper, as stated, deals primarily with the indirect technic. The operator must have a model of the cavity, the so-called die, mounted in correct position in an articulated plaster model of that section of the jaw in which the tooth to be restored is present. This enables him to carve a wax pattern that will insure proper contacts and occlusion in the finished inlay. The die, or model, should be made by depositing copper in the wax or compound impression of the cavity by means of electrolysis. This gives an accurate model that does not present the dimensional variations occurring when amalgam is used for making the die. Copper plated dies made from compound impressions of the Bureau of Standards crown and mesioclusodistal dies will allow a casting that seals perfectly on the die and the bureau's model. If the casting is made to an amalgam replica of the bureau's die, it will fit the amalgam die, but not the original model.

Inlay casting waxes possess physical properties that must be recognized by the dentist if he is to produce an accurate wax pattern. T. W. Maves has made a statement that explains many of our difficulties in making accurate castings, for the improper manipulation of inlay waxes is the cause of many discrepancies in the pattern as well as misfits of the casting. Maves says,[10]

> Distortion of present known inlay waxes is not controllable except to a certain extent, as its occurrence in any particular location cannot be depended on. . . . No two results

of tests for distortion or expansion are ever alike; only an average is possible.

Inlay waxes act similarly to other materials when they are heated or cooled; that is, they expand on heating and shrink on cooling. They possess an elastic property that makes them very unstable, and this property is hard to keep under control, owing to irregularly shaped cavities and the stretching and compressing which waxes undergo while being manipulated.

An inactive wax is one kept at constant temperature with the molecules at rest. This is the ideal condition just previous to investing, but it is extremely difficult to attain and is our greatest problem in wax manipulation at present.

An active wax has been subjected to temperature changes and the arrangement of the molecules has been disturbed, and while they are attempting to rearrange themselves, expansion or contraction of the wax occurs, depending on the temperature change. This molecular movement persists until a state of stabilization or equilibrium is reached, and the molecules will stay in this condition until the temperature is changed. For example, let us assume that a piece of inlay wax just removed from the container in which the manufacturer has packaged it is stable or in the inactive stage. We heat it and compress or stretch it into a cavity in a die or in a tooth, and frequently chill the wax to hasten its hardening. The rise in temperature, the manipulation of the wax, then the drop in temperature incident to chilling place the wax in an active state. As the temperature reaches a constant point, the wax tries to become inactive or the molecules attempt to reach a state of equilibrium. In making a wax pattern by the direct technic, the wax can be chilled to about 95° F., or open-mouth temperature, and stabilization started, but when the wax is removed from the tooth and a drop to room temperature occurs, stabilization is again interrupted and distortion will occur. At what center or area in the wax this happens is unpredictable, it depending on the shape and size of the wax pattern. This appears to be a factor to be considered in using the direct technic, and is a source of variables difficult to control.

Stretching (tension) or compression of wax, which occurs when it is manipulated to secure the pattern, will also disturb molecular arrangement while the wax is under stress or strain. After the stretching, or bending, which is a combination of compression and tension, or compressing has occurred, the wax has a tendency to return to its original form. The molecules also try to assume their original relationship to each other after the stresses disturbing them are removed or cease. This can easily be proved by heating and bending a stick of inlay wax, then allowing it to cool to room temperature, and watching its attempt to return to its original shape. In other words, elasticity is eliminated by cooling and released by heating.

Since wax that has been thoroughly softened, or even melted, is in a nonresistant state and is less susceptible to these reactions, it appears that melted, or "poured," wax would give more accurate patterns than softened or "manipulated" wax. Some operators have proved that wax that has been melted or poured into a mold and then allowed to cool to room temperature without any pressure has the least distortion even when temperature changes do occur; and, conversely, a manipulated wax is distorted more with less temperature change than is a poured wax. Melted or poured waxes, according to Van Horn,[11] do not lose their physical properties, as the wax sticks while being manufactured are shaped by pouring melted wax into molds without affecting the physical properties of the waxes.

WAX PATTERN TECHNICS

The dentist's query is, naturally, "What technic should I use in producing

a wax pattern?" I have written to a dozen prominent inlay workers asking them to describe their technic in securing a wax pattern for a mesioclusodistal, or three-surface, cavity. Nine of the men use the indirect technic only on rare occasions. The other operators described their methods in detail. Each seems to have his own mode of procedure, yet all obtain accurate fits.

A good example of individual variation in procedure is the material used to lubricate the die before the wax pattern is made. The following substances were suggested: saliva, glycerine, lard oil, cocoa butter, commercial die lubricant and a mixture of two-thirds castor oil and one-third cotton seed oil.

Waxes were softened to a workable plasticity with dry heat by some operators and with hot water by others. Matrices were used by some; others compressed the wax into the die with the fingers. Some allowed the wax to assume room temperature before carving; others hastened hardening by chilling in cold water. Some operators melted the wax along the margins and burnished it; others melted the wax 1 mm. from the margins, allowed it to become soft and plastic and then pushed it against the margins and filled in the open space that resulted with melted wax. It appears that the personal equation enters into all these procedures, and so they are empiric rather than scientific.

The ideal procedure in securing a wax pattern would seem to be as follows:

1. The die is lubricated with a suitable material and warmed to minimize wax shrinkage due to contact between the cold surface and the melted wax.

2. A matrix is fitted to the die and the inner surface of the matrix lubricated.

3. An inlay wax which meets the American Dental Association specification is melted and poured into the cavity in the die, which is surrounded by the matrix.

4. Pressure is placed over the wax in the matrix on the die and maintained while the wax assumes room temperature.

5. The matrix is removed and the wax carved to form with suitable sharp instruments. Marginal discrepancies are overcome by taking a hot inlay carver, melting the wax 1 mm. from the margins, allowing it to become softly plastic and, with an unheated inlay carver, burnishing the wax body to and over the cavity margins, filling in the discrepancy left in the wax body after this burnishing with melted wax. Wax should be burnished over margins and not carved away, and the carver should always rest on tooth surface and wax simultaneously, to prevent discrepancies along the margins.

As stated before, wax that is in a nonresistant state is less susceptible to elasticity reactions, as it is not stretched or compressed; therefore, dimensional change is lessened when it is cooled to room temperature and maintained there. Expansion is controlled by the cavity walls of the die as well as by the matrix around the tooth and the pressure exerted from the occlusal portion of the wax by the operator will counteract shrinkage. Pressure from the occlusal surface is necessary, as wax shrinks to a common center away from the cavity walls, and this explains why occlusal and cervical inlays, which are one-surface in form, are so difficult to fit accurately.

Modifications of this technic are advocated by C. S. Van Horn, who suggests a so-called "wax-tray technic." After the wax is compressed in the matrix on the die, it is removed and the inner surface of the pattern is painted with melted inlay wax with a No. 2 badger brush. The wax and matrix are replaced on the die and allowed to cool. The procedure is then the same as outlined above for finishing the wax pattern.

My experience when making wax patterns for the Bureau of Standards dies that were used for checking various in-

lay technics several years ago convinced me that poured waxes were the most accurate. The mesioclusodistal and the full-crown dies had brass sleeves that acted as matrices and a brass cap fitting over the cavity ends of the die and matrix. The die, matrix and cap were lubricated and warmed, then melted wax was poured into the die with the matrix in position. The cap was placed in position and held under pressure until the wax assumed room temperature, when the final carving was completed. This procedure gave more satisfactory results than any other technic that I had used, but I have not been able to adapt it to practical cases owing to the shapes of the dies resulting from our various cavity preparations.

It is difficult to fit a matrix in a die used for practical cases with the indirect technic, as the matrix should extend beyond all cavity margins to allow the wax to flow past them, and yet the melted wax should be confined to prevent leakage. The matrix should be rigid enough to withstand a reasonable amount of pressure while the wax is assuming room temperature. This phase of wax manipulation will, I believe, warrant the attention of investigators of an inventive turn of mind, for it seems logical to assume that a more stable wax pattern will result with a poured wax technic, if it can be successfully developed.

The dentist must make his selection on the basis of his clinical experience and his understanding of the physical properties of inlay waxes. He must know how they are influenced by manipulation and develop a means of keeping them under control as nearly as possible.

Karl Elander has suggested that all inlay wax patterns be annealed by immersion in water at 112° F., standing at room temperature for two minutes and then being invested immediately. This procedure relieves internal strains and stresses with their molecular interlocking, and stabilizes the wax. Many direct inlay workers anneal the wax pattern after it is finished and is in position in the cavity of the tooth by using a stream of water from 110 to 115° F. for one or two minutes, after which the wax pattern is removed from the cavity and invested at once.

Sprue pins should be made of brass or stainless steel, and several sizes should be available, ranging from 13 to 18 gage. The sprue pins should not be heated and sunk into the wax pattern, but a wax ball should be placed at that point on the wax pattern where the sprue pin is to be placed and the pin luted to this elevation of wax. Finally, great care must be used to remove the wax pattern from the die so as to prevent any possible distortion of the pattern.

Cavity preparation for gold inlays has been developed continuously and conservatively for a number of years, and the dentist can feel assured that the present cavities will be very satisfactory for the present technics.

However, the problem of wax manipulation presents a field for study, for we know little about the present inlay waxes and the best technic to follow in manipulating them. Each operator has his pet theories or methods of procedure, based, unfortunately, on empiric practice rather than on scientific fact. Let us hope that this important step in inlay technic will receive more attention in the future, for many known, and probably many unknown, variables are present and their actions are unpredictable, making this the weakest link in the gold inlay technic.

I have endeavored in this presentation to bring out the fact that although the present system of cavity preparation is satisfactory, wax manipulation is still a problem, solution of which will afford us a better technic in our attempts to repair diseased teeth and bring them back to a healthy and useful state.

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Campus Building.

WAX ELIMINATION AND CASTING OF GOLD INLAYS

By Victor T. Nylander, D.D.S., Chicago, Ill.

IN inlay technic, it is evident that the most important step in a satisfactory gold restoration is the preparation of an intelligently extended and definitely clean-cut cavity with polished enamel walls and sharp cavosurface angles. Here the ideal is established and the first link in the chain of a long technic is secure and sound.

The wax pattern having been completed and adjusted to the tooth in the mouth, it becomes necessary for us to thoroughly examine it after its removal in order to eliminate all possible errors and defects, rendering it ready for investing and thus saving as much time as possible in the finishing time of the casting. All traces of tooth shavings must be removed from the cavity. All traces of blood and saliva must be eliminated. Invariably, a rough casting surface is present on the portion of the casting from which tooth dust, blood and saliva have not been eliminated. The pattern should not be handled in the hand, and especially should one be careful not to touch the margins with the fingers.

The size of the sprue-former will vary according to the type of casting machine used, the size of the pattern and the amount of pressure applied in casting. It is preferable, however, to use the smallest sprue-former possible and still insure a satisfactory casting. With an air-pressure machine, a smaller sprue-former would be used, whereas, with the centrifugal machine, with which the gold is melted on a crucible away from the ring, one of larger diameter is generally suggested. We use a sprue-former slightly larger in diameter than an ordinary pin for the two-surface casting, with an air pressure machine and about 25 pounds of casting pressure.

The sprue-former should be inserted in the greatest bulk of the wax and in a

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position where it will not mar nor effect the anatomic carvings. In other words, in a two-surface restoration, it is preferable to place the sprue-former midway between the buccal and lingual margins of the pattern and on outer portions of the marginal ridge, not forcing it into the pattern. The sprue-former should be perfectly clean so that it will adhere easily to the pattern when it melts its way slightly into it. By holding the sprue-former in the fingers and heating the point of it, the danger of overheating and distorting the pattern will be reduced. The wax pattern, when securely placed on the sprue-former, can be handled conveniently for the cleansing and dressing for investment. Small additional carvings can be made and slightly overhanging margins removed with delicate sharp-cutting instruments at this time.

The pattern is washed to remove saliva and blood, and any particles of tooth dust that may remain attached to it are shaved off. Saliva and blood are best disintegrated and removed with a camel's hair brush dipped in hydrogen peroxide, the wax being gently brushed, and then washed with cold water. This may have to be repeated before all traces are removed. After the pattern has been washed, it should be thoroughly dried with cold air, then examined to see whether the interior portion of the wax is of uniform texture and that it has been firmly pressed into all parts of the cavity. It is generally advisable to dust the dried wax pattern with investment powder of the same type that is used for investing the pattern. This dusting is done with a camel's hair brush and all excess is blown off with a cold chip blower so that there will be no lumps of investment remaining. The presence of these very fine particles of investment will aid in producing a smoother casting and also in making the investment adhere very easily to the pattern at the time of placing the investment.

The pattern with the sprue-former should now be attached to the sprue base in such a manner that it will have an equal amount of investment around it. The ring that we use for holding the investment material is lined with asbestos. This will give the investment an opportunity for proper expansion without being locked by a metallic ring which does not have the same coefficiency of expansion as the investment. This asbestos lining should not extend the full length of the ring, but should be left about an eighth inch short of each end so that the investment will not have a tendency to drop out at the time it is dried. A ring about seven-eighths inch in diameter seems just as satisfactory as a large one and is more economical and more quickly prepared for casting.

MIXING THE INVESTMENT

The standard investments on the market today are very satisfactory. The dry ingredients are quite uniformly mixed and of fine texture and they set sufficiently hard to withstand ordinary casting pressures. They are accompanied by definite directions and expansion charts. Manufacturers' directions, however, though quite accurate, necessarily must be general, in that their products are sold and used under various climatic conditions and must be mixed with different types of water. We, therefore, must improve on the directions by adjusting them to our particular location and working conditions. Investment material should be remixed in the office to insure a uniformity of mixture of the entire contents of the can. The heavier, more granular particles sink to the bottom during the process of shipping or shaking, and thus the mixture is unbalanced in various portions of the can. The mineral content of the water affects the setting conditions, as does also its temperature.

It is advisable to weigh, or measure, the amount of investment necessary for the particular mix, also the exact amount

of water needed to produce a heavy, creamy consistency. After a few trials, a definite proportioning will be established.

The investment material should be kept in a tightly sealed metallic can; otherwise, considerable moisture will be picked up during a humid day; whereas, on dry days, moisture will be given off, and the balance will be incorrect. Some form of mechanical mixer is essential for the best results. The mixing time varies according to the speed of the spatulator, type of investment and temperature of the water. Usually thirty seconds is a satisfactory time. Prior to starting the spatulator, all particles of investment must be thoroughly saturated by the water. After spatulation is complete, the investment is thoroughly vibrated to remove all traces of air and water bubbles that may be incorporated in the investment. This will also bring to the surface any water bubbles that may remain.

With a tapered sable brush, dipped deeply in the investment, a uniformity of investment for the painting of the pattern is procured. The pattern should be painted in such a manner that there will be no danger of trapping air in any of its sharp angles. Trapping air can generally be avoided by starting the painting from the bottom and working upward, pushing the investment with the bristles of the brush. By gently vibrating the edge of the base with a serrated instrument, the investment will be securely seated against the pattern. However, care should be exercised to avoid excessive vibration at this stage. The invested pattern can now be either placed on the moistened ring and filled with investment material, or the wet ring can be placed on the sprue base and investment material can be poured around it.

The pattern should be invested as soon as possible after it has been completed. It should not be left standing in either the laboratory or the office, where there are varying temperatures and air currents or where it might be damaged by other means. In other words, it should be put under lock and key as soon as possible after it has been completed.

The investment should now set undisturbed until it will break with a clean fracture. This time varies according to weather conditions, the investment used, the amount of spatulation, etc.

We do not use any control powder. However, we do not object to its use. If a better result can be assured with it, it should be used. Just as accurate results can be obtained through controlling the thickness of the investment and the heat during wax elimination.

After the ring is removed from its base and the sprue former is removed, the opening and the surface of the investment forming the crucible should be examined to make sure that no particles of investment are driven off and carried into the sprue opening during the process of elimination and casting.

WAX ELIMINATION

Wax eliminators of various types are a mere convenience. No particular improvement in the results were noted after trying various types. They do assure more uniform temperature control. An ordinary Bunsen burner seems about as satisfactory as any eliminator, if judiciously handled. The object of elimination is (1) to drive off the excess water that was incorporated in the investment to make the mix thin enough to be satisfactorily placed on the investment; (2) to remove or completely volatilize the wax pattern without leaving any carbon or ash in the mold proper, and (3) to cause the necessary expansion to the mold by increasing the heat, and thus expanding the investment. The investment, however, should not be broken down by intense heat to the point that the water of crystallization is removed

and the investment weakened. A hot spot of heat should not be directed on any portion of the investment.

In the first stage of elimination, therefore, heat sufficiently low that the excess water will be slowly evaporated is employed so that no confined steam will be formed within the investment, thus putting undue tension on it. The length of time that this elimination must continue varies according to the intensity of heat, the amount of the investment and the size of the ring. After the excess water has been removed and no sign of moisture remains, the second degree of heat should be applied. This heat should be intense enough that the mold will absorb the major portion of the wax, the remainder being volatilized or burned off. Thus, all portions of the investment particles forming the inner casing of the mold are coated with a fine layer of carbon.

In this manner, the investment forming the mold will be definitely antifluxed with carbon, which is repellent to flowing gold. If this fine layer of carbon is allowed to remain, the casting will be a great deal smoother than if all the carbon is completely eliminated.

This heat is continued until all smoking ceases, after which the higher heat is applied until the chocolate color is completely removed from both ends of the investment in the ring. We do not use the color indication of either a red ring or a reddish sprue opening, as we believe that the castings are not so smooth and are frequently overexpanded for inlay purposes when the investment is judged by these conditions. The color gage of a red ring means a great number of different temperatures on a dark day or in a dark spot in the laboratory. The red may vary from 300 to 400 degrees from the same color effect noticeable near sunlight or under any other strong illumination. Color is not a satisfactory gage. The time and length of flame, arrived at by experimentation, is a great deal more accurate and satisfactory. We prefer to make our castings at a temperature of from 750 to 850° F.

When the case is ready for casting, the gold should be prepared by melting and fluxing on a charcoal block, and by being dropped into clean acid while still hot. This removes the impurities. The excess flux is removed and the investment reheated on the charcoal block, and transferred while hot to the crucible and cast immediately, without any waste of time. The ring and mold will very quickly lose heat and begin to contract.

CASTING GOLDS

For inlay purposes, it is preferable to use a comparatively soft gold that can be easily burnished. It is generally advisable to add about one-half the amount in new gold to the previously melted nugget in order to produce a satisfactory flow. The gold should be melted as quickly as possible with a controlled flame that has the least tendency toward oxidizing it. The flame should also be sufficiently intense that the casting can be made in less than a minute of heating. The gold should not be overheated, nor should it be too heavy or insufficiently heated. Overheating the gold and driving it with force into the mold will invariably result in a rough casting, especially if the investment is slightly overheated.

The amount of gold necessary for making the casting will vary according to the size of the pattern. There should be an excess amounting to about one-half the size of the casting. The use of too great an excess produces a backward pull on the casting itself, because the excess cools much more rapidly than the interior of the mold. Thus, there is porosity at the junction of the two masses, and sometimes complete separation.

As soon as the redness has disappeared from the gold, the casting can be quenched. It must be freed from all traces of investment by brushing and heating and by dipping in clean acid

and neutralizing in a solution of sodium bicarbonate. It is then ready to be examined and dressed for trial in the tooth.

CASTING MACHINES

Casting machines are a convenience. We do not wish to work without them, but one will not produce a better casting than another. Technics of their handling vary slightly, but the general principle is the same whether an expensive casting machine or a home-made product is used. The technic for the particular machine must be thoroughly mastered, and the casting pressure held down to consistently satisfactory results. Too high pressures tend toward overtension on the investment and forcing the gold into the investment interspaces that line the casting mold, thus producing an unnecessary roughness. The final result is not based on materials and equipment only, but on materials and equipment and their intelligent management.

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SETTING AND FINISHING GOLD INLAYS

By W. Ira Williams, D.D.S., Chicago, Ill.

WHEN Dr. Johnson revised his text on operative dentistry in 1910 to include the gold inlay, he devoted twelve pages to describing the technic, only seven lines of which were devoted to discussing setting and finishing. He says:

> After setting, but before the cement has hardened, burnish all margins that cannot be reached with a disk. Then polish the margins accessible to a disk, running the disk across the margins at right angles and from the inlay towards the tooth. This spins out and burnishes down a fine margin of gold so thoroughly that after this polishing is completed, no cement is visible even under a magnifying glass. As to cements for setting, the writer advises the hydraulic cements.

On reviewing the literature, I find that about this same proportion of space has generally been given to this subject, probably the most important step in the inlay technic.

In an article read before the Seventh International Dental Congress in Philadelphia, in August 1926, M. A. Gates states that the technic to be followed in the cementation of a gold inlay is of far greater importance than is generally realized. It seems impossible to overestimate the value of this part of the inlay technic.

No matter how well we prepare the cavity, or how nice a casting we obtain, if the inlay is not set properly and finished well, the restoration is a failure.

Setting and finishing include proper contact, occlusion and contouration to restore the anatomic tooth form of that particular mouth; sterilization of the cavity and keeping it dry; the mixing and handling of cements; seating the inlay; removal of excess cement, and final burnishing and polishing of the margins.

CONTACT

It is difficult to establish the proper contact in the wax, which is usually too full or not full enough. If it is too full, the inlay may not be properly seated; if not full enough, addition must be made or the restoration will be a failure. I have seen failures from both of these faults. I find the best procedure is to

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disregard the contact until the inlay is properly seated and corrected, then add a little 18-carat solder. This produces a hard surface at the contact point and assures that marble-like contact that the tooth had in the beginning.

CONTOUR

Even with the excellent wax patterns that Dr. Nylander makes, I venture to say the contour may be altered after the casting is made, particularly on the proximal surface. If the direct method is used in securing the wax pattern, it is difficult to get the proximal surfaces trimmed to proper fulness. This should be checked in the casting to see that there is no infringement on the interproximal gum tissue, nor any overhanging margin to cause irritation of the gingivae.

The occlusal surface must be examined after the casting. The inlay must be properly seated before cementing, and necessary corrections made. The occlusal anatomic form of the teeth should conform to that of the other teeth. If there is considerable occlusal wear, the inlay should conform to this condition. If the occlusal surface of the opposing tooth (or teeth) is to be altered, this should be done at the time of cavity preparation, and the reason be given the patient, as otherwise he may think you are cutting down a good tooth to fit a bad inlay.

The patient should not be forced to wear the inlay into proper occlusion. With the hard golds of today, much damage can be done to surrounding tissues by failure to adjust the occlusion at the time of setting the inlay. The carbon paper method is a good one for finding the "high spots."

After seating, and before the cement is too hard to remove the inlay, in case it is not properly seated, the excess cement should be wiped off and the occlusion tested by having the patient close. If the occlusion is correct before cementing, it should be after cementing, if the inlay is properly seated.

STERILIZATION OR NEUTRALIZATION OF THE CAVITY

My theory as to the cause of the decalcification of the teeth that is commonly called caries or decay prompts me to use a different system of sterilization, or what is more properly designated neutralization. I am convinced that this disease is the result of permitting sugar to remain on the surfaces of the teeth long enough to ferment and break down into an acid, which decalcifies the tooth at the spot. So I start neutralization with cavity preparation by a thorough cleaning of the surfaces of the adjacent teeth, or, better still, a general prophylaxis, if the number of cavities indicates a very susceptible mouth.

If the cavity does not extend too near the pulp, I wash it thoroughly with a saturated solution of sodium bicarbonate, wipe it dry with cotton and place a temporary stopping until the inlay is made and ready to set.

If the cavity is extensive and near the pulp, I wash it thoroughly with the soda solution (always keeping the saliva out afterwards), dehydrate with grain alcohol and warm air and use a thin mix of carbo-eugenol paste, or use just the carbo-eugenol liquid before placing the temporary stopping. If I use a cement base, it is placed over carbo-eugenol paste.

There is always the question as to whether tooth structure can be sterilized in the mouth. I believe if we use these precautions known to be harmless and which are probably helpful, not many pulps will die nor inlays come out because of decay under them. I have capped pulps with carbo-eugenol paste when there was actually a small exposure at the horn, but a good wall of dentin at the base of the cavity, and they have caused no trouble in more than five years. Vitality tests show that the pulps are still vital and roentgenograms show no periapical change. I am not advocating capping exposed pulps: I merely mention this to show that decalcification can be

arrested by cleaning out a cavity and excluding sugar rather than employing sterilization. I use the carbo-eugenol paste more as an anodyne than as a sterilizing agent.

CEMENTS

I cannot go into the chemistry and physics of the different cements for two reasons: the lack of time and the lack of knowledge of them. A. E. Webster, in THE JOURNAL of September 1927, says that oxyphosphate cements are gradually being displaced by the silicates as filling materials. They must be looked on as very temporary filling materials. They are, however, most valuable in dental practice.

There are only two cements that should be used in cementing gold inlays, oxyphosphate of zinc and oxyphosphate of copper. I have used both over a period of twenty-five years and I cannot see any difference as to the length of time the inlay stays in or as to irritation to pulps. I have seen very few teeth in which the pulps died from irritation from the cements, even the silicates, especially in the last ten years. Neither have I seen any more inlays come out when copper cement was used than when zinc cement was used, and I do not believe that golden brown powder is stronger than cream colored powder.

The success of cementation is in the handling of the cements. The manufacturers make very fine cements today and tell us how to use them. If we follow instructions, we shall have no trouble, but we do not always master the technic and then we fail; or we get in a hurry, and when we see that a mix is not just right, instead of making it over, we take a chance, and the result is a faulty restoration.

Sometimes, we allow the assistant to mix the cement before she has been thoroughly trained to do it. The late W. D. N. Moore, one of our finest inlay technicians, always had his assistant keep the cavity dry and he mixed the cement. His patients never had a bad margin around an inlay.

A cement made by one of the reliable manufacturers should be selected and his instructions studied. A few bottles of cement might well be wasted in working with it until the mixing technic is mastered. The dentist should not listen to every salesman that comes along saying that his cement is better. As with automobiles, all cements are good. Success depends on the way we handle them.

SETTING TECHNIC

The inlay should be ready to be tried in before the temporary stopping is removed and, if possible, the cavity should be kept dry, especially if a neutralizing agent is sealed in the cavity. The inlay is seated and is tested for overhanging margins at the gingival and high spots on the occlusal surface. The contours and contact point are checked. After adjustments are made and the inlay is polished, the cavity is checked to make sure that it is dry and that it will stay so while the cement is being mixed.

A generous amount of powder and liquid is placed on a clean, dry smooth slab of a temperature between 65 to 75° F. With a good-sized spatula, a small portion of the powder is placed in the liquid and the mixture thoroughly spatulated. Small portions of the powder are continuously added and by rolling the spatula, the entire mixture is moved until a smooth creamy mixture is obtained. Then with an instrument that will reach all angles of the cavity, a film of the cement is carried to all surfaces of the cavity, and the cavity surface of the inlay is covered and the inlay seated as quickly as possible.

The inlay is tapped into place with the mallet and a burnisher or an orangewood point. The patient is requested to

bring the teeth together if the occlusal surface is involved, to assure proper seating. If the occlusion was correct in the fitting, the cement is wiped from the margins and checked to assure the seating of the inlay. The whole is kept dry until there is a reasonable amount of setting. The excess cement should not be removed until it will chip away clean. This should take from five to ten minutes if the mix is satisfactory. I wish to stress the importance of removing all excess cement. In many cases, irritation of the peridental tissues has been caused by the presence of cement at the proximogingival margin of inlays.

Final finishing should be easy with the use of fine stones, disks and strips drawn toward the margin. If the contact is involved, floss should be passed between the teeth to aid in removing any cement particles. A final checkup of the occlusion is made with tracing paper, and the mouth is thoroughly sprayed with warm water.

My plea is for the same study and perfection of technic in the finishing and setting of the inlay as are stressed in cavity preparation, waxing and casting of the inlay. They are the making of a successful restoration.

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PHOTOGRAPHY FOR THE ORTHODONTIST—A SIMPLE AND EXPEDIENT CLINICAL TECHNIC

By C. W. Carey, D.D.S., San Jose, Calif.

PHOTOGRAPHS taken routinely in the office may be used for a variety of purposes. Whether they are to be used for diagnosis, education of the public, practice building, clinical records, papers and exhibits or for the satisfaction of the patient, they should be standardized as to position, tone, lighting and size, and should be taken quickly, accurately and without office confusion so that the more important operations may proceed with uninterrupted routine.

The method that I have been using for several years has fulfilled these requirements and I offer my experience with this clinical technic, and a description of a simple office equipment, in the hope that it may be as useful and provide as much satisfaction to those who wish to incorporate standardized photography in their practice as it has to me.

At the first appointment, while the assistant is preparing the materials for the impressions, the front view, profile and oral view pictures are taken, about five minutes' time being devoted to the entire operation. The equipment used is shown in Figures 1 and 2. The diagrammatic sketch (Fig. 3) shows in detail the parts of the apparatus that are mounted on the wall and by means of which accuracy in the finished photographs is possible.

The apparatus consists of two units, the camera platform unit (Fig. 3, A), which is mounted approximately 40 inches from the floor, and the head positioning unit (Fig. 3, B), which is mounted 5 or 6 feet from the camera platform on the same wall or on an opposing wall, the choice depending on the size of the picture desired, the focal length of the lens and the convenience of the office space. A suitable camera is

Fig. 1.—Patient in position for front view portrait.

Fig. 2.—Patient in position for oral view.

set in place on the adjustable camera platform (1) secured with screw (2) and fixed with stabilizer (3). By focusing the camera on the background wall and marking the points on the wall at the intersection of two diagonal lines on the ground glass at the highest and lowest positions of the camera platform as it slides up and down on the vertical calibrated rod (8), the head positioning

unit (Fig. 3B) is mounted with a template as a guide.

A line connecting the two points on the background wall represents the range of the lens axis of the camera, and the head positioning unit is mounted a definite distance either to the right or to the left of this line. This unit, when mounted, is in a definite relation to the camera platform unit, so that the lens axis of the camera passes directly in line with the two orbital points on the face-bow (4) when the patient is adjusted for the profile picture. The patient's head is also fixed by the ear piece (5) which points to the upper border of the tragus so that the axis will be in line with the horizontal plane. The face-bow is attached to the receiving end of the profile extension (Fig. 3,[6]) for this picture.

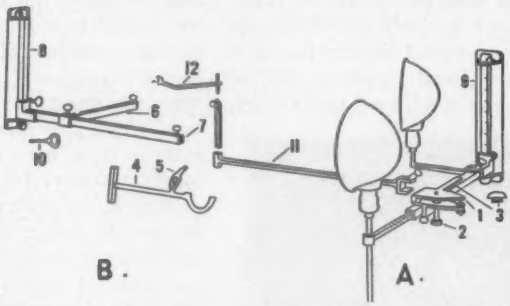

Fig. 3.—1, camera platform; 2, tripod screw; 3, camera stabilizer; 4, facebow; 5, ear piece; 6, profile extension rod; 7, insertion for facebow; 8, vertical calibrated rod; 9, calibrated rod; 10, lock key; 11, mouth picture attachment; 12, incisal bow.

Fig. 4.—Front view.

Fig. 5.—Profile.

The front view photograph is taken

by placing the patient in position behind the facebow, which is now detached from the profile extension arm (6) and applied to the extremity of the horizontal rod (7). The lens axis now passes directly between the two orbital marks and is in line with the horizontal plane of the head. The chair on which the patient is seated should be on rollers and should carry a small headrest. At the time the facebow is adjusted to the head,

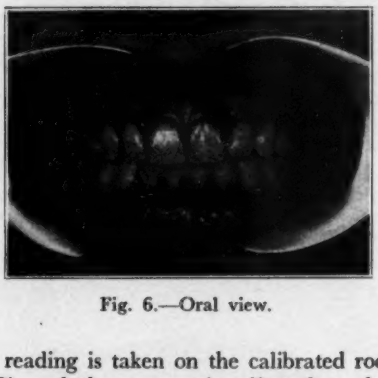

Fig. 6.—Oral view.

a reading is taken on the calibrated rod (8) and the camera is adjusted to the same height by setting the platform at the same reading on the calibrated rod (9). This adjustment is necessary because of variations in size of the patients.

Focusing the camera is eliminated. Fine, accurate focus is established at the time the instrument is mounted, and a mark is placed on the focusing scale. Both pictures are taken at this mark. When the picture is to be taken, the lights are turned on, the key (10) is removed and the horizontal arm is swung out of the way.

For the oral view, the patient is brought to position in front of the attachment for this purpose (11) and the incisal bow (12) is turned until it stops at a right angle. Mouth retractors are used, and when the bow is in line and in contact with the incisal arc of the anterior teeth, the lights are turned on, the incisal bow is turned back and the picture is taken. These pictures require fine focusing, and as it would be too time-consuming to focus for each picture, a mark is placed on the focusing scale so that, once done, focusing is no longer necessary for succeeding pictures.

Models are photographed in the same manner by being placed on a platform which fits in place of the incisal bow. If a number of models or groups of models are to be photographed, it is best to slide the camera and platform off the horizontal rod, turn them over and slide them on again so that the camera is directed at the floor. The models are set on the floor or on a low table covered with black velvet, and the camera and lights raised or lowered to the proper height and adjusted for focus.

The photographs are made to definite scale, quarter, third or half size, by setting the units a definite distance apart, depending on the focal length of the lens; that is, if the camera has an 8-inch focal length lens, the distance from film to orbital points for quarter size would be 50 inches.

The equipment requires little office space and, when not in use, can be collapsed against the wall by simply detaching the camera and folding the horizontal arms upward.

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FURTHER ROENTGENOGRAPHIC STUDY OF MANDIBULAR THIRD MOLARS

By L. R. Main, D.D.S., St. Louis, Mo.

MUCH has been written on the mandibular third molar. Much more will be written, as this tooth presents problems which are not common to other teeth. The location of the mandibular third molar makes complications frequent in the regular process of eruption. Frequently, lack of space in the mandible gives rise to distressing symptoms and, for some unexplained reason, this tooth sometimes chooses to develop in a position that makes normal eruption impossible. Occasionally, any tooth may be impacted, but the lower third molar is perhaps impacted more often than all other teeth combined.

Much valuable information about the peculiarities of this tooth has been obtained with the advent of the x-rays in dental practice. Most of the guesswork about its location and position is now eliminated, and most of the difficulties presented when an effort is made to remove it can be anticipated. Still many fine points in the reading or interpretation of the roentgenogram of the mandibular third molar must be considered before operative procedure is instituted, in order to avoid complications as far as possible.

Every impacted or unerupted mandibular third molar should be carefully studied whether there are local symptoms or not. I have not become so enthusiastic as to recommend the removal of every impacted third molar, for we have seen a few so deeply impacted and so greatly misplaced, and in which there were absolutely no discoverable local or general symptoms, that I would hesitate to immediately condemn such teeth.

In the interpretation of roentgenograms of mandibular third molars, there are several conditions to be considered, most of which have been mentioned in the literature from time to time. There are, however, two possible findings in some roentgenograms which are frequently overlooked, one of which I have never seen mentioned in the literature. I refer to that condition in a well-made roentgenogram which enables one to tell definitely whether the calcifying or the fully formed third molar is impinging on the mandibular canal. As this can be determined in practically every case, I am submitting a few roentgenograms that indicate pressure on the canal, and other roentgenograms of deeply impacted teeth in which there is no pressure or impingement.

The other point referred to is, in instances in which definite pressure is demonstrated in the roentgenogram, what symptoms might possibly be present because of this pressure and what is the responsibility of dentists when certain symptoms are present.

As to the first point, how to determine whether there is pressure or impingement on the mandibular canal by a third molar from the roentgenographic viewpoint, the position of the canal in the mandible varies greatly. In some instances, the canal may be deeply seated, as in Figure 1, and be close to the lower

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border of the jaw. Again, it may be very high and run close to the upper margin of the jaw, as in Figure 2. In both instances, the condition would be considered normal.

The location of the canal within the bone means very little from the standpoint of impingement. Naturally, a calcifying tooth is not so likely to impinge on a deeply placed canal as on one located near the upper margin of the mandible, but we cannot be guided by the position of the canal as far as impingement is concerned. The so-called occlusal view of the molar area does not furnish the information because the density of the teeth precludes showing the course of the canal in this region. (Fig. 3.) In the occlusal view (Fig. 4), the shadow of the molar teeth and the canal falls in the same plane, and naturally the shadow of the canal cannot be seen.

Fig. 1.—Deep-seated canal.

Fig. 2.—High mandibular canal, close to upper margin of jaw.

The evidence of impingement can be seen in a regular roentgenogram of the third molar region, made in the conventional way. When there is definite impingement, there is a fading away of the root of the tooth, or the root of the tooth is darker at the point where it touches the canal. (Fig. 5.) Sometimes, this fading away is so great that it is impossible to completely outline the root or roots. (Fig. 6.) Where there is no impingement, the density of the roots is the same throughout, in the roentgenogram.

The advantages to both the patient and the operator in correctly interpreting these roentgenograms are, of course, obvious. Where pressure by a third molar is demonstrated in the roentgenogram, care must be exercised to avoid injury to the mandibular nerve, if removal of the tooth is considered. Many cases of paresthesia could be avoided if correct interpretation of roentgenograms was made before operative procedures were instituted. Figure 7 shows such a case. As the correct interpretation of the roentgenogram was made in advance, the molar was cut in two and the crown removed first, then the roots were removed carefully, and no postoperative complications whatever developed. In this case, had the roentgenographic findings been ignored, and the usual method of dislodging the tooth by placing an elevator under the mesial surface of the crown of the third molar and forcing the tooth up

Fig. 3.—Dry specimen; wire in canal.

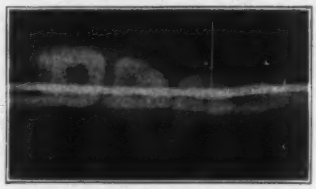

Fig. 4.—Dry specimen, occlusal view; wire in canal. The canal is not disclosed.

past its contact with the second molar been employed, great harm to the mandibular nerve would no doubt have resulted.

The following cases demonstrate the position of the mandibular canal and also show the fading away of the root of the tooth when there is pressure or impingement on the canal. In Figure 8 there are four cases in which the roots of the third molar extend beyond the canal, but there is no impingement. In Figure 9, there are four cases in which fading away of the roots of the teeth

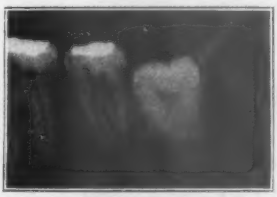

Fig. 5.—Fading away of root at contact with canal, indicating impingement.

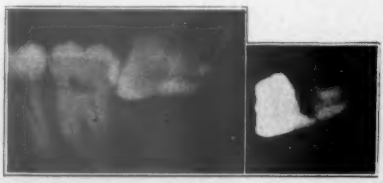

Fig. 7.—Apex of root impinging on canal.

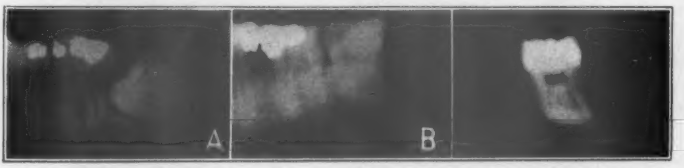

Fig. 6.—Fading away of root at contact with canal until contour of root is lost.

where the roots and canal are in contact is apparent. In such cases, there is impingement on the canal.

Where we suspect impingement on the mandibular canal, what symptoms may be found as a result of this pressure? Very frequently, there are no local symptoms, and the patient is sometimes unaware of the presence of the third molars. There may be symptoms other than local, however, and it is our responsibility to inquire into the general health of our patients when such teeth are discovered. Not infrequently, so-called headaches and ear complications result from impingement of a third molar on the mandibular canal. The third molar does not always have to be impacted to cause pressure, for occasionally the tooth may be entirely erupted and still be impinging on the canal.

Sometimes, such pressure on the canal is a factor in reflex complications. True reflexes are conditions developing in some other nerve than the one where the pressure is exerted. These reflex disturbances are manifested in structures supplied by other nerves than the trifacial. Therefore, in some instances of gastric complications which cannot be accounted for through other examinations, it is reasonable to suspect pressure from the mandibular third molar on the canal, giving rise to such symptoms through the tenth cranial nerve (vagus) or possibly through the sympathetic nervous system. Such symptoms, of course, would be due to reflex complications and not to infection. Many gastric disturbances have been relieved by removing such teeth. Such symptoms as numbness in the hand or forearm are sometimes corrected when the pressure on the canal by a mandibular third molar is relieved. (Fig. 10.) This condition was probably brought on by a reflex disturbance through the cervical sympathetic system

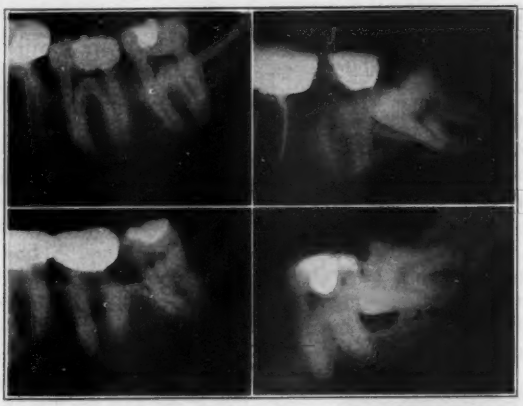

Fig. 8.—No fading away of roots, indicating no pressure on canal.

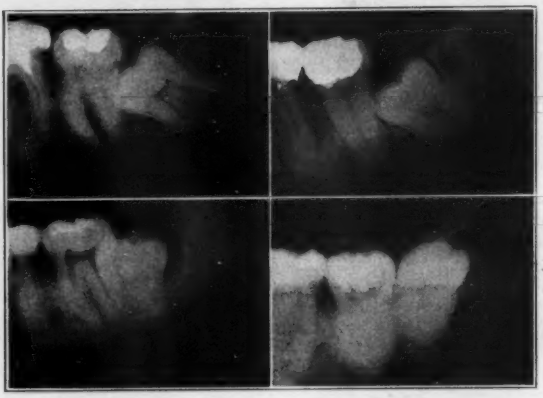

Fig. 9.—Fading away of roots, indicating pressure on canal.

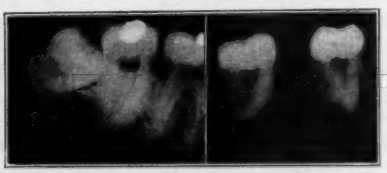

Fig. 10.—Indications of pressure on canal. The tooth has built itself around the canal, definite reflex complications of median and ulnar nerves resulting.

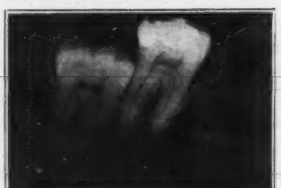

Fig. 11.—Pressure on canal causing reflex complications.

and the cervical and the brachial plexus of the spinal group of nerves. The cervical portion of the sympathetic system communicates directly with several of the cranial nerves, and perhaps the vidian nerve, which connects the sympathetic with the nasal ganglion of the trifacial nerve, is a factor in such symptoms.

Figure 11 indicates definite pressure on the canal. The patient, aged 31, had used glasses for twelve years. The removal of the third molar corrected a defect in accommodation and the glasses were discarded.

Since reflex disturbances may be of dental origin, careful histories of cases must be secured. The age of the patient is very important. Should general symptoms develop about the time that the third molars are calcifying, and if these symptoms cannot be accounted for, consideration of the likelihood of complications from the dental viewpoint would be rational.

PRESIDENT'S ADDRESS

By C. Willard Camalier, D.D.S., Washington, D. C.

DENTISTRY in the United States is progressive both in thought and in action. Its conservatism, if it may be so called, is only in direct relation to its desire to protect the quality of service and consequently the health of the people of the United States. Therefore, I desire to lay emphasis on the word "progressive," in furtherance of the understanding that the dental profession is aware of its responsibilities to society and desires to move forward safely and sanely in its increased ministrations toward the well-being of the people. However, it should be recalled that professional education now requires two years of predental and four years of dental training, plus postgraduate work, and the licentiates are accustomed to dealing deliberately with research problems and experiments. If they have learned any lesson well, it is that successful experiments are the result of clear thinking and careful planning. Naturally, therefore, they view hasty action in matters relating to the delivery of dental care as an unwise if not a dangerous procedure. This attitude is even more applicable to the physician, who today undergoes a most arduous course of study and training, more intensive and hazardous, in my opinion, than is the case with any other professional or technical worker.

Delivered at the First General Meeting of the Eighteth Annual Session of the American Dental Association, St. Louis, Mo., October 25, 1938.

THE PROFESSIONS AND PROGRESS

I become somewhat impatient with the criticism of the medical profession for its seeming conservatism, since it is a group of persons primarily interested in the desire to do good, persons who are humane and philanthropic beyond comparison and who conduct their practices under a code of ethics unsurpassed by that of any other group. The objections to certain methods of practice are not based on selfishness, but are due to the belief that the quality of service, by and large, to the individual may be adversely affected. I plead for patience and a most careful consideration of the viewpoint of the dental and medical professions before changes are instituted in the finest dental and medical systems in the world, systems that, as a matter of fact, are today the pride of every American. Who is it, then, that because of a greater philanthropic or altruistic attitude is in a logical position to criticize?

The American Dental Association is

not against progressive change. As a matter of fact, the opposite is true. The Association was glad to cooperate in the deliberations of the recent National Health Conference and will render all aid and assistance possible to officials of the government in efforts to improve the health of the people. The United States Public Health Service under its able leader, Dr. Thomas Parran, and the Children's Bureau of the Department of Labor, with Miss Katherine Lenroot, director, are doing excellent work in their respective fields, and our Association now has advisory committeees working with them. The Dental Corps of the Army and Navy and of the Veterans Administration have the support of the Association, and it is largely through the efforts of the American Dental Association that these services have been established and brought to their present high grade of efficiency. The component societies in the various states, counties and cities work quite harmoniously with the departments of health and school officials, in an intense effort to improve the health of the communities, with special reference to the children of the nation.

Improved programs undoubtedly will eventually be worked out, but they should be safe and sane in order to accomplish what they are supposed to do; namely, to save life and decrease human suffering. The opposite condition could easily result if plans not approved by the organized profession are adopted, not only destroying the faith of the people in the health service practitioners, but also taking from the heart of the individual practitioner the primary impulse that led him to enter his profession; namely, the desire to heal the sick. Unbiased consideration by all interested groups is the proper method of procedure, and the American Dental Association stands ready to assist.

In addition to our various committees working on these matters, a special advisory committee to the Board of Trustees has recently been appointed to study the present status of the problem, including the deliberations of the recent National Health Conference, and to report its decision as to the proper course of action to pursue at this time.

THE PROBLEM OF DENTAL DISEASE

The members of the dental profession realize that they are confronted with a serious public health problem. Dental defects are the most prevalent of all diseases, with the possible exception of the common cold.

A survey of 1,500,000 school children made in 1933-1934 by members of the dental profession in cooperation with the United States Public Health Service, in which 4,800 dentists in twenty-six states contributed more than $2,000,000 in time and service, disclosed that approximately 90 per cent of American children of school age suffer from dental decay. Studies on a smaller and more detailed scale made subsequently to this large survey have confirmed these findings.

Until further dental research demonstrates some method whereby dental disease can be prevented, the objective of the dental profession is to control it in its incipiency.

The American Dental Association, after serious consideration of this phase of the public health problem, believes that the logical approach is through adequate prenatal and postnatal nutrition and medical care, plus the detection and correction of dental defects early in childhood. This must be brought about largely through education. It has been demonstrated that if adequate dental service is provided the preschool child, plus correction of small defects in early school life, the occurrence of complicated dental diseases will be materially reduced, and if this type of program is followed, the ultimate cost to the community for proper dental service will be greatly reduced.

Realizing that the prevention of serious

dental defects will reduce some of the catastrophic and other serious systemic conditions in later life, as well as add to the comfort and appearance of the citizens of the country, the American Dental Association during the past two years has laid tremendous emphasis upon dental health for the child. In 1937, the Association adopted as its slogan, "Preventive Dentistry in the Interest of Health." In 1938, it adopted "Dental Health for American Youth." Under these inspirational themes, the following important measures have been carried out.

MEASURES TOWARD PREVENTION

State and component dental societies have intensified their preventive dental programs.

The Association has furnished leadership in the establishment of divisions or bureaus of dental health in state boards of health, tripling the number in three years.

State and component dental societies have been stimulated to cooperate with the National Congress of Parents and Teachers in their summer roundup campaigns.

Realizing that the technic of handling and performing dental operations for children is intricate and of a highly specialized nature, the Association has advocated refresher courses in children's dentistry. These courses have been conducted for dentists in Georgia, Utah, Oregon, Missouri, Michigan and Indiana, where they have been enthusiastically attended and received. Similar courses are now being planned in many other states for the coming year, and the value of refresher courses is being emphasized as a special feature at this meeting.

Under American Dental Association leadership, courses in dental health education are increasing in teachers' and nurses' training schools.

The Association has requested state and component societies to inaugurate dental health programs in all child-interested groups, such as the Parent-Teacher Association, Boy Scouts, Girl Scouts, Camp Fire Girls, 4-H Clubs and the American Red Cross.

The Association, through its Bureau of Public Relations, has developed and distributed large quantities of dental health educational material to the public, through schools, boards of education, boards of health and other channels. Incidentally, this year, a national dental poster contest for school children was fostered to bring preventive measures to the people of the United States. About a half million posters were prepared and 2,000,000 contacts made. Five thousand posters are displayed here in St. Louis in our Youth Health Lane. The contest had three distinguished judges: Dr. Parran, Surgeon-General of the U. S. Public Health Service, Miss Katherine Lenroot, chief of the Children's Bureau, and Mr. James L. Fieser, vice-chairman of the American Red Cross. The awards in this contest will be made at the General Meeting tonight.

The dental profession realizes that some provision must be made for emergency service, such as the relief of pain, the elimination of infection and some restorative work, at community expense for those adults of the present generation who cannot provide this service for themselves, and plans are being studied by our various committees in seeking the best solution of the problem.

As previously stated, however, the dental profession believes that the long-term preventive program for children is the most feasible and practical program for the control of dental disease.

DENTAL PROGRESS ON OTHER FRONTS

In addition to the program above mentioned, dentistry is moving forward on other fronts:

1. Interest in public health dentistry is rapidly growing as shown by the fact that we now have twenty states with

a dentist on the governing body of the state health department. Twelve states have separate and distinct dental divisions; thirty-four are conducting some form of dental health activity through their respective state departments of health; twenty-six have full-time licensed dentists in charge of their respective dental programs, and five have part-time dentists in charge of their dental programs. This is a significant advance; but it is my belief that every state, city and county in the Union should have at least one dentist on the governing body of its health department, every one should have a separate and distinct dental division and all should have an adequate dental health program, approved by the organized dental profession in the respective jurisdiction.

2. The dentists connected with dental health departments or bureaus should be adequately trained for this special service. To facilitate an increase in this type of education, more of our universities should install recognized courses of instruction in dental public health.

3. Of ninety-three of our cities with populations of more than one hundred thousand each, five have full-time dentists and ten part-time dentists administering city dental health activities. For many years, the dental profession has taken the leadership in establishing dental clinics for school children and I am sure will continue to approve their establishment provided, of course, the service is limited to early life and to the underprivileged. It was not intended that the free school dental clinic should be made available to all school children, as this would be impractical, expensive and unfair to the private practice of dentistry. The Association has noted with some degree of concern the tendency to care for children whose parents are able to pay, thus limiting the service available to the needy children of the nation. The Association reiterates that a comprehensive dental educational program should be inaugurated in every community in the United States in order that preventive measures may be stressed and the necessity for dental service to adults and children be reduced to a minimum. The emphasis should be placed on educational preventive measures rather than on correction.

4. The American Dental Association emphasizes that the most important problem before it is the dental health of the child, and a slogan carrying out this idea should be adopted for at least a five-year period.

5. With a realization of the importance of further progress in the art and science of dentistry, with special reference to surgical and hospital procedure, it is believed that there should be a dental intern in every suitable hospital in the United States. Approaches should be made along this line to the various hospitals.

6. During the past twenty years, the American Dental Association has expended approximately four hundred thousand dollars in research, but it is believed that this is still a virgin field. The Research Commission of the American Dental Association has recommended the institution of a fellowship in dental research at the National Institute of Health under the U. S. Public Health Service. It is believed that this would be extremely advantageous. Recently, it has come to my attention that an intensive research program will in all probability be promoted at Walter Reed General Hospital under the direction of the Surgeon-General and the Dental Corps of the United States Army. The Association is glad to endorse and assist in programs of this character in the hope that they will reduce suffering, decrease dental disease and consequently minimize the liability to more serious diseases later in life.

7. The Association looks forward to an improved program under its Dental Mu-

seum Committee, and points with pride toward the advances now being made in this connection at the Army Medical Museum. I trust that the Congress of the United States will authorize at its next session the construction of a new Army Medical Museum in place of the celebrated but antiquated one now in Washington, D. C., and that in this new structure dentistry will have its proper place.

8. During the past year, the Association authorized a new council on dental education to take the place of the Dental Educational Council of America. The original council, established in 1909, accomplished much in the elevation of dental education in the United States. The new council, which becomes a standing committee of the American Dental Association with the full support of that organization, should prove invaluable in further efforts to elevate the standards of dental education. The Association regards this as a most progressive step.

9. The Association for several years has given its endorsement and support to the National Board of Dental Examiners, an organization similar to the National Board of Medical Examiners.

10. The Council on Dental Therapeutics and Bureau of Chemistry have been operated conscientiously and efficiently for a number of years, and recently, under authorization of the Board of Trustees, the scientific and technical service in these departments has been increased to effect a more efficient organization.

The activities of the Council, supplemented by the work of the Bureau of Chemistry, are directed in the larger sense toward the scientific advancement of the dental profession. Specifically, the Council works to attain this worthy goal by application of the principles of pharmacology, chemistry, bacteriology, pharmacy, physiology and clinical dentistry to dental materia medica and therapeutics. Publication of the findings of the Council therefore serves the twofold purpose of acquainting the profession with the nature of products and procedures in the field of dental therapeutics and the reasons for their acceptance or rejection.

11. For many years, the Association has supported a fellowship at the United States Bureau of Standards in Washington, D. C., under which materials relating to restorative dentistry are tested and standards established which manufacturers adopt in making or refining their materials. This assures the dentist, and ultimately the public, that proper dental materials will be used in restorative procedures.

12. At the February meeting of the Board, the Association was authorized to cooperate in every feasible way in the world's fairs to be held in 1939 in New York City and in San Francisco, Calif. Tentative appropriations of five thousand dollars were made in each case. All members of the profession are urged to visit these fairs, which will undoubtedly have fine dental exhibits.

13. The American Dental Association, during the past year, recommended to the American Red Cross that one or more dentists serve on each of the Red Cross preparedness committees throughout the United States, a recommendation which was favorably received. The profession believes that it has its place in doing what it can to relieve the suffering of refugees in disasters and is glad of the opportunity to serve humanity in this respect. I desire to express my appreciation to the officers of the American Red Cross, particularly Mr. James L. Fieser, vice-chairman, Dr. William DeKleine, medical director, and Mr. Robert Bondy, for their cooperation in this effort, and to our own Red Cross Committee, Drs. Harvey J. Burkhart, chairman, E. G. Meisel and Philip E. Adams.

14. The Association has looked with apprehension on a tendency in some sections of the country for persons to furnish dentures by mail. The Association condemns this practice and urges its elimination as promptly as possible. Even if it were possible for persons to take proper impressions of their own mouths, and of course it is not, careful insertion, adjustment and supervision by qualified dentists are necessary to prevent undue pressure on the tissues of the mouth, which, if not corrected, may result in malignant growths. The Association cannot stress too earnestly the danger incident to such procedures, as well as the impossibility otherwise of furnishing this type of service to the public. The United States Post Office Department has already issued a fraud order in one case, and it is believed that the courts will sustain this action.

15. The Association anticipates advances in dental legislation. In the famous case of Semler *vs.* the Oregon State Board of Dental Examiners, Chief Justice Hughes said:

> The legislature was not dealing with traders in commodities, but with the vital interest of public health, and with a profession treating bodily ills and demanding different standards of conduct from those which are traditional in the competition of the market place. The community is concerned with the maintenance of professional standards which will insure not only competency in individual practitioners, but protection against those who would prey upon a public peculiarly susceptible to imposition through alluring promises of physical relief. And the community is concerned in providing safeguards not only against deception, but against practices which would tend to demoralize the profession by forcing its members into an unseemly rivalry which would enlarge the opportunities of the least scrupulous. What is generally called the "ethics" of the profession is but the consensus of expert opinion as to the necessity of such standards.

The Association represents approximately 75 per cent of the eligible practicing dentists in the United States, and has, after careful deliberation, created a code of ethics under which the membership should conduct their practice. Ethics, as the Chief Justice has said, is "but the consensus of expert opinion as to the necessity of such standards." It is therefore, according to the Supreme Court, perfectly logical and proper that this Code of Ethics should be the yardstick by which all practicing dentists govern their ministrations to the public. Unfortunately, a small percentage of licensed dentists do not conform to this Code of Ethics. Believing firmly that the health of the people of the United States is more adequately protected under such reasonable regulation of the profession, the American Dental Association urges the legislatures of the various states and the Congress of the United States to require the entire dental profession by law to comply with a code of ethics which is in fact "the consensus of expert opinion as to the necessity of such standards." As a concrete example of legislative progress, there was introduced into the Congress at its last session a bill to amend the act for the regulation of the practice of dentistry in the District of Columbia, containing a provision requiring compliance with the Code of Ethics of the American Dental Association. This bill was introduced in the Senate by Senator William H. King of Utah and in the House by Representative John Cochran of Missouri, who has just addressed you. I desire to acknowledge our debt of gratitude to Mr. Cochran for his indefatigable efforts in behalf of this legislation. May I ask for a rising vote of thanks? The charlatan and quack should be driven from the shores of America in order that this profession, the pride of Americans, shall not further be defiled and can march forward more proudly and more efficiently as a true health service.

16. The Association at this meeting is

attempting to bring to a fitting climax for the year its program under the theme "Dental Health for American Youth," and at the General Meeting on Thursday evening is presenting a symposium on the care of children's teeth, for the benefit of the dental profession and the public. Under its health and scientific exhibits, which, by the way, are the largest in the history of the organization, there has been created a special section entitled "Youth Health Lane," in which five thousand dental posters made by school children in the United States will be on display, as well as many beautiful exhibits on children's dentistry. This particular exhibit stresses prevention in the interest of health and should be of great value to the public. Thousands of St. Louis school children will visit this exhibit and view the motion pictures to be shown at the end of Youth Lane. Under the Section on Oral Hygiene and Children's Dentistry, programs in the interest of children are being emphasized, with outstanding leaders as essayists, one being Miss Katherine Lenroot, chief of the Children's Bureau of the Department of Labor.

COOPERATION WITH FEDERAL AND STATE GOVERNMENTS

It should be apparent to all, therefore, that the American Dental Association is, at least, attempting to be progressive in its efforts to bring better dental health to the people of the United States. As stated before, it is glad to cooperate with federal and state governments in any feasible and ethical plans in connection with the dental needs of the American people. To this end, it has offered and has now functioning in several instances committees advisory to the federal government. Many states and cities cooperate with the Association's constituent and component bodies, with the result that the minimum of friction has developed. In other words, in the great majority of cases, the profession has been consulted. In the State of Missouri, however, it has been brought to my attention that a WPA dental project totaling originally more than $382,000 but now reduced to $115,000 has been approved by the State Board of Health of Missouri and forwarded to the WPA in Washington, without acceptance of the proffered advice of the organized dental profession of this state. Such a procedure is inexcusable and unbelievable, and I am surprised that officials in Washington would even consider it. They are, I understand, depending on the advice of the state department of health. Of the commissioners of health of the various states with whom I have come in contact, I have yet to find one who has not been anxious for the cooperation of the dental profession. The Works Progress Administration, under the authority of Mr. Hopkins, was glad to avail itself of the offer of the Association for the creation of an advisory committee on dentistry, and it seems that common sense would dictate the necessity for similar cooperation in each state.

CONCLUSION

I urge that dentistry adopt an even more progressive public health viewpoint, provided the quality of service be protected, the principle of free choice of dentist by the patient, and vice versa, be assured and professional leadership and control prevail; that the profession place emphasis on the preventive program for children, making the slogan "Dental Health for American Youth," a reality and not a play on words, and that the care of the indigent and of the low-income groups be given most careful and definite consideration and action by the profession, to the end that the health and the comfort of the people may be immeasurably improved. The general health of the patient is, of course, paramount, and with this cared for by the physician,

the results of the above-mentioned suggestions will be the improvement in school standing and behavior habits in children, the lessening of crime and delinquency and the mental and physical uplift of the entire citizenry. With confidence in the good judgment of the people, with American traditions firmly embedded in its conscience, American dentistry moves forward, sure of its mission, of its necessary place in American life and of its ability as a health service profession to adequately serve the people of the United States.

PROBLEMS IN CLASS II MALOCCLUSION

By Howard E. Strange, D.D.S., M.S.D., Chicago, Ill.

A CONCEPTION of normal occlusion cannot be confined entirely to harmonious relationship of the teeth. A student of orthodontia must possess a knowledge of the function and anatomy of the related parts; namely, the muscles, osseous structures and parts directly related to the denture in function. There is a reciprocal relationship of all these parts operating through the force of the inclined plane relationship of the teeth. There is a definite and normal inclined plane relationship of the teeth of the lower arch to those of the upper, and the dental arches have a definite and harmonious relationship to the normal architectural and cranial anatomy. Functional efficiency of the masticating mechanism is dependent on a harmonious relative location and normal functional arrangement.

There are many factors of significance in making an adequate case analysis. If the observations of occlusion and of related structures are limited to a two-dimensional assessment, length of the arches in the anteroposterior direction and width of the arches in the lateral direction, we do not obtain a clear perspective of the problem under consideration. A complete and thorough three-dimensional analysis will indicate the need for a certain type of management or program of treatment. Maxwell recently said, "Functional activity involves action, and centric relationship is of no more importance than each and every one of the innumerable instantaneous denture relationships where motion is involved." Centric occlusion is a static relationship of the denture, and as treatment progresses, we must project our observations into the dynamic relationships—the path of travel and functional relationships of the cusps and condyles in all functional ranges of motion. Dynamic relationships with particular reference to inclined plane and cusp relationships, axial inclination of the teeth and curvature of the contact occluding relationships indicate the necessity of a three-dimensional consideration of any problem of malocclusion.

In making a survey or analysis of any problems that in turn determines the corrective procedure, it is practically impossible to accumulate adequate information by observing casts in which the occlusal plane is parallel to the base of the art portion of the plaster cast. The denture, in most instances, deviates from the horizontal plane, and a cast in which

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the pitch of occlusion is shown in its relationship to the Frankfort horizontal plane affords us a better perspective. An operator observing occlusal relationships properly oriented on a cast can more readily appreciate the value of a three-dimensional observation in case analysis. (Fig. 1.)

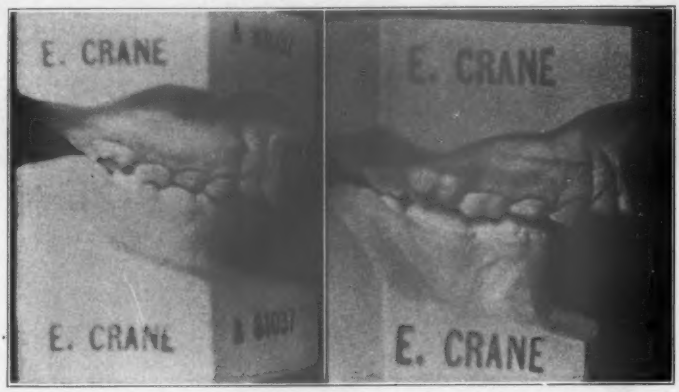

Fig. 1.—Left: Gnathostatic cast showing pitch of occlusion in relation to Frankfort horizontal plane, top of cast. Right: Ordinary orthodontic cast of same case in which line of occlusion is oriented parallel to base of cast. These models indicate that the weight of occlusal stress falls upon the mesial sections of the lower first permanent molars. The mesio-axial perversion of the lower molars is evident, and the occlusal thrust force of the mesiolingual cusp of the upper molars is not directed into the central fossae of the lower molars.

Fig. 2.—Occlusal view of lower denture from gnathostatic cast. A uniform and standard art portion enables the operator to determine mesial drift and other valuable data in case analysis. In this case, there is evidence of mesial drift in the left buccal segment.

The work of B. Holly Broadbent has clearly pointed out that in Class II, Division 1, malocclusion, the face as a whole is subnormal with reference to its anteroposterior dimension, the mandible being relatively more so than the maxillae. Normal vertical dimension is lacking, the body of the mandible is short and there is a considerable lack of growth at the angle of the mandible. (Fig. 3.)

An understanding of the problems encountered in analysis and treatment necessitates consideration of the biomechanics associated with the evolvement of any malocclusion. What were the forces that caused the malocclusion, and what prevented proper development of the jaws and face?

Consideration of the biomechanics associated with the evolvement or production of a Class II, Division 1, malocclusion will indicate the problems in treatment. In any habit in which there is a slight perversion in muscular traction, there is a disturbance of the normal growth plan of the denture and face. Improper swallowing habits and mouth breathing cause an abnormal backward

Fig. 3.—Typical Class II, Division 1, case; inadequate facial development.

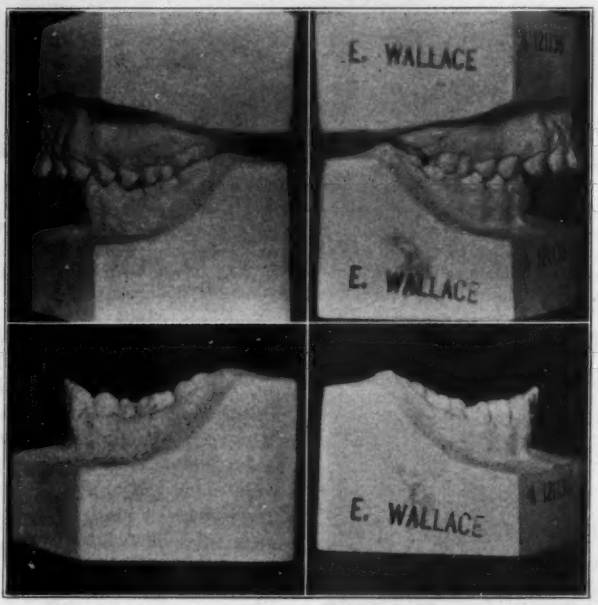

Fig. 4.—Models of Class II, Division 1, case. The molars are in malalinement, a backward thrust on the mandible resulting. There is an abnormal spherical relationship between the upper and lower arches. The lower models indicate the excessive and short curvature of the mandibular denture. It is impossible for the premolars to erupt to normal spherical relationship because the mesially tipped mandibular molars encroach on the space that should be occupied by these teeth.

pull on the body of the mandible and a consequent distal locking of the inclined planes of the molars. In some cases, we find that intrinsic causes, such as the presence of carious deciduous molars, and too early loss of deciduous teeth, favor a distal locking of the inclined planes of the molars. A shifting of the teeth into improper position and relation prevents normal function of the jaws, and thereby prevents normal growth and development. When the mandibular molars are forced into a posterior relationship with the maxillary molars, the

weight of occlusal stress is on the mesial marginal ridge of the lower molars, causing these to tip excessively in a mesial direction.

A three-dimensional observation clearly indicates the abnormal, excessive mesial-axial inclination and resulting infraclusion of the mandibular molars. In many cases, the upper molars have a disto-axial inclination and the axes of the upper molars are in approximate harmony with the axes of the lower molars. Analysis of the improper axial relationship or inclination of the molars in Class II, Division 1, malocclusion should be convincing enough to indicate that there is a constant backward thrust on the mandibular teeth and their supporting bony bases. Forward growth of the mandible is hindered, and there is a lack of coordinated function of the muscles.

Spherical relationship is necessary for lateral and protrusive movements of the mandible. Spherical congruency of the maxillary and mandibular dentures does not exist and the curvature of the mandibular denture is accentuated by the excessive mesio-axial inclination of the lower molars and the infraclusion of the premolars. (Fig. 4.)

Vertical development is inadequate, and the mandibular incisors are in supraversion and usually occlude with the tis-

Fig. 5.—Inadequate vertical development; mandibular incisors in supraversion occluding with tissue behind maxillary incisors.

Fig. 7.—Abnormal inclination of maxillary and mandibular teeth; stress of mastication causing forward thrust of mandible.

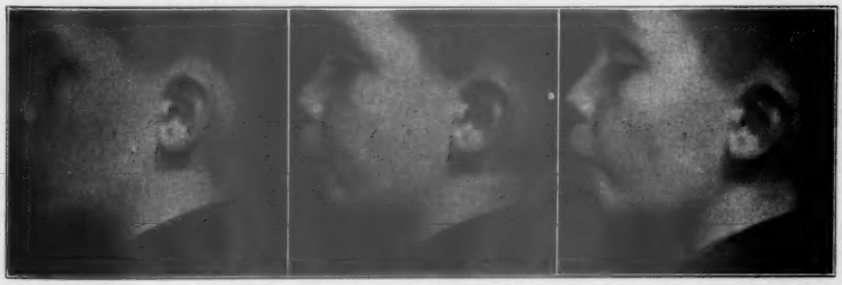

Fig. 6.—Abnormal function of swallowing in Class II case. The upper lip is short and the lower lip pushes itself against the lingual surfaces of the maxillary incisors.

sue directly behind the maxillary incisors. (Fig. 5.)

In Class II, Division 1, cases, there is usually an abnormal swallowing function. The upper lip is short and normal closure of the lips is practically prohibited by the protrusion or labio-axial inclination of the maxillary incisors. The lower lip pushes itself under and against the lingual surfaces of the upper incisors. The lack of balance in function of the muscles surrounding the lips and the hyperactivity of the mentalis muscle prevent normal forward growth and development of the lower jaw. (Fig. 6.)

For comparison and in order to more adequately portray the abnormal backward thrust force in Class II, Division 1, cases, a brief consideration of the forces active in Class III malocclusion will stress the importance of an analysis of mechanical forces at work.

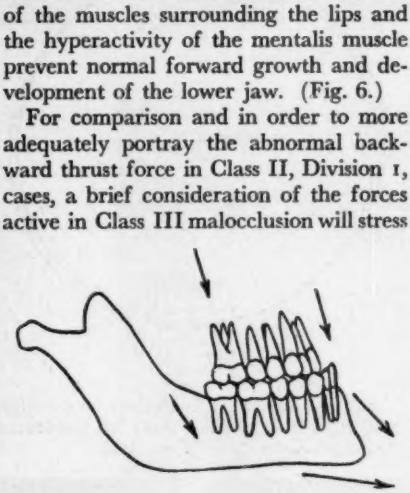

Fig. 8.—Forward growth restrained by backward thrust on mandibular teeth in short mandible.

Figure 7 indicates that the maxillary and mandibular teeth are abnormally inclined, and the stress of mastication causes a forward thrust on the mandible. The mandibular teeth are in disto-axial inclination, and the teeth in the upper arch harmonize in inclination with the lower teeth. The abnormal forward relationship of the mandibular dental units and body of the mandible to the skull is due to the forward thrust transmitted through the action of the inclined planes in functional stress. The body of the mandible is long and the angle obtuse, there being, in some cases, almost a straight angle. The diagrammatic illustration of the thrust force in Figure 7 is to be compared with that of Figure 8.

The body of the mandible is short and forward growth is restrained by the backward thrust on the mandibular teeth. The mandible is shaped to best resist the stress of mastication and support the teeth that are receiving a force on the occlusal surfaces in a backward direction. (Fig. 8.)

Those interested in occlusion can accumulate a great amount of helpful knowledge from Dr. Maxwell and his group of workers. They have convincingly indicated that there is a definite vertical positioning of the teeth anteroposteriorly and buccolingually, and the normal positioning of each dental unit in the arch resolves itself into a geometric spherical congruency. Figure 8 diagrammatically indicates the relationships of the maxillary and mandibular spheres at centric occlusion in a typical Class II, Division 1 case. Point A represents the location of the center of the mandibular sphere, point B, the location of the center of the maxillary sphere, and the circumference is greater and the radius much longer than in the mandibular sphere. There is a lack of mutual conformity between the two spheres, and

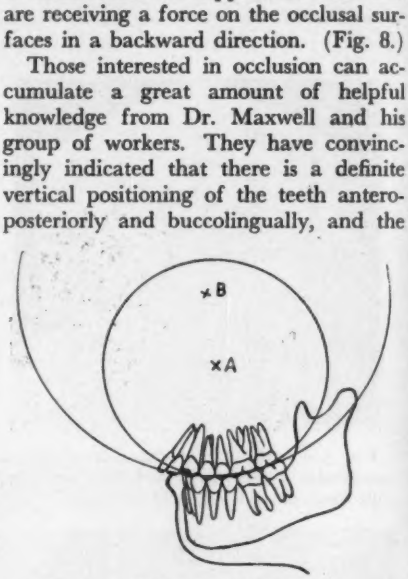

Fig. 9.—Relation of maxillary and mandibular spheres and relative location of spheres at centric relation in normal occlusion. (Maxwell's diagram.)

spherical congruency does not exist. An abnormal relationship of this type prohibits normal functional movements, and there is no ease of action and balance with muscular function and action in the functional movements of the teeth and jaws in mastication.

Figure 9 (G. H. Maxwell's diagram) indicates the relationship of the maxillary and mandibular spheres and the relative location of the spheres at centric position in normal occlusion. The position and location of the temporomandibular joint necessitates this curvature or contact occluding spherical relationship. Congruency of the mandibular and maxillary spheres allows the teeth to function efficiently in the various lateral, protrusive and all functional ranges of mastication.

There must be a definite inclined axial positioning of the denture units, and each denture unit (lower and upper meeting in a contact spherical relationship) may be considered as an active component force. The meeting of these mesially inclined vectors produces an anterior resultant force. This resultant action is an anterior propelling force, and an equilibrium is maintained by the strong muscular pull exerted on the denture and its basal supports in a posterior direction.

The major problem in Class II, Division 1, is a realinement of the units of force so that functional activity tends to promote forward growth of the mandible and face. If no attention is directed to the third dimension (the proper axial inclination or relationship of the teeth), the backward thrust force will continue to be in operation at the completion of treatment, with a consequent tendency toward a relapse.

Figure 10 shows a simple Class II case that I treated several years ago. The third dimension was not considered in case analysis, and, as a result, a relapse occurred after the completion of treatment. Expansion of the lower arch was accomplished and the incisors were moved forward. No attention was directed to the excessive mesial-axial inclination of the mandibular cuspids. Stationary anchorage was established in the lower jaw, and a 17-gage labial arch extending away from the incisors was used on the maxillary arch. The arch was ligated into buccal tubes on the banded first permanent molars. Intermaxillary elastics were utilized to tip the molars back. After the proper inclined plane relationship of the molars had been established, the arch was placed against the maxillary incisors and allowed to slide through the buccal tubes on the molar bands. Intermaxillary elastics were used to move the incisors back. Bands with open tube attachments were placed on the incisors to complete the alinement. After fourteen months of active treatment, the case was put in retention. The maxillary

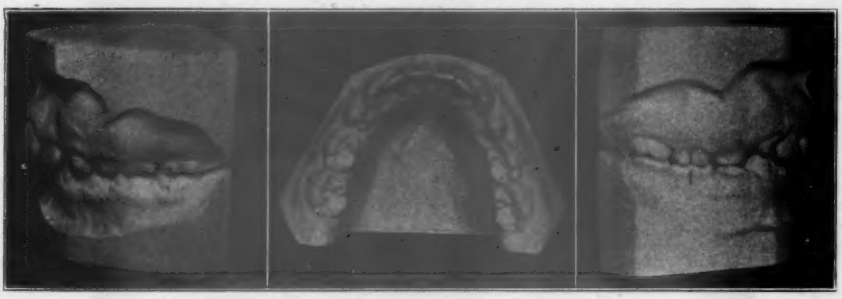

Fig. 10.—Simple Class II case in which relapse occurred because third dimension was not considered in case analysis.

arch was retained by a Hawley retainer, and the lower by a fixed lingual arch extending from molar to molar. The retaining appliances were removed after a year of retention, and in three months the patient returned.

Figure 11 is an illustration of neglect of attention to the third dimension or vertical alinement of teeth in case analysis. There is a definite mesial drift of the lower teeth, and bands with rectangular anchor tubes were placed on the molars. Vertical spring loops were incorporated in the edgewise arch and were used to move the molars and premolars in a distal direction. Ideal arch form was established in the lower arch, and the lower jaw was utilized for stationary anchorage. Bracket bands were placed on the maxillary teeth, and the

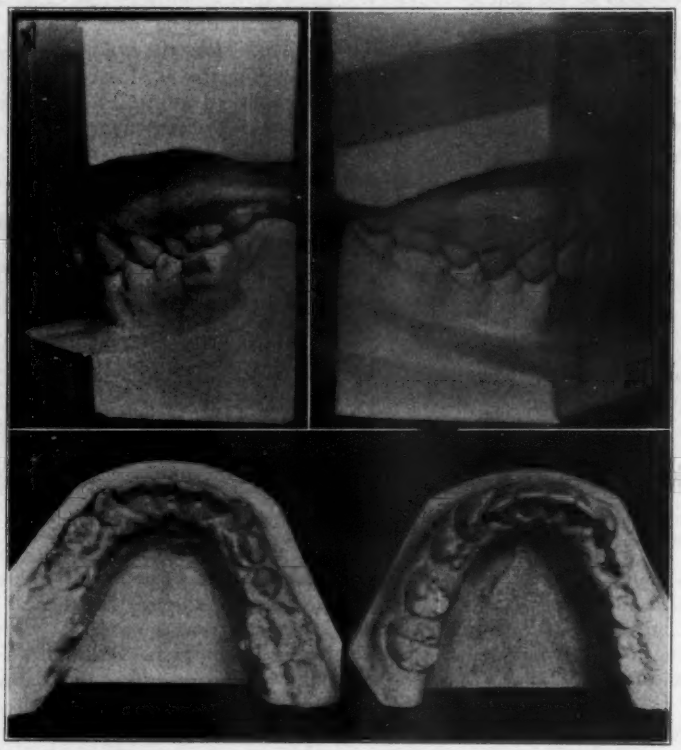

Fig. 11.—Inclined plane relationship of molars apparently indicating Class I case. The molars are in Class I relationship because of the mesial drift of the mandibular buccal segments.

the mandibular buccal segments, and the lower cuspids are in excessive mesial axial inclination. The tendency toward a backward thrust on the mandible exists.

Active treatment was again commenced. Bracket bands were placed on teeth were moved distally by the use of tip back bends and intermaxillary elastics. Active treatment was necessary for approximately eight months, and the same method of retention was used.

Figure 12 indicates the result obtained

after two periods of active treatment in a simple case made embarrassing and difficult through a lack of adequate information regarding the forces of occlusion.

Figure 12 indicates the changed inclination of the cuspids, and Figure 13 the contact relationship in the cuspid lateral area before and after correction.

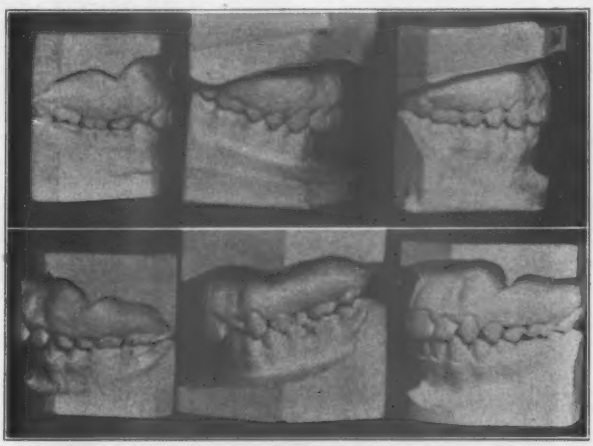

Fig. 12.—Left, models of case before active treatment. Center, models after first period of treatment and retention. Right, models showing results after second (proper) method of correction was employed.

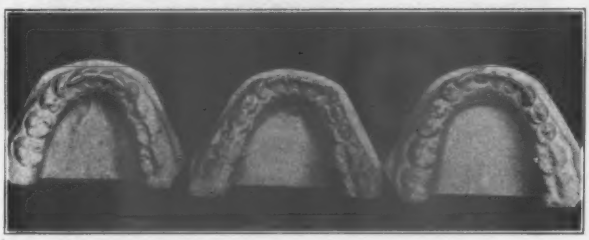

Fig. 13.—Contact relationship in cuspid lateral area before and after correction.

In Class II cases, the body of the mandible, with its superimposed denture, is posteriorly from its normal anatomic relationship with the skull. To summarize briefly, the factors associated with the evolvement of a Class II, Division 1, malocclusion are:

1. Habits or abnormal muscular traction causing a distal locking of the inclined planes.

2. Lack of muscular pressure against the labial surfaces of the maxillary incisors except the pressure against the apical sections of the upper incisors.

3. Exaggerated curvature of occlusion of the mandibular denture and an absence of spherical congruency in the contact relationship of the maxillary and mandibular denture.

4. Improper coordinated function of the muscles and the abnormal pull on the body of the mandible by muscles attached to the body of the lower jaw.

5. A distal inclined-plane relationship of the molars and increased mesial axial

inclination of mandibular molars favoring a distal thrust on the mandible.

6. Perversion of the mechanical forces of occlusion so as to produce a backward thrust on the mandibular denture and prevent normal forward growth of the mandible.

The main problem in treatment is a general realinement of the teeth in order to establish forces in function which will tend to develop and maintain the mandible in a normal mesiodistal anatomic relationship to the skull. Growth and development of the jaws is influenced by the functional forces emanating from the meshing and pounding of the occlusal inclined planes as well as by environmental muscular pressure.

In many cases, the abnormal muscular functions are automatically corrected when a correct relationship of the jaws and teeth is established. The buccal teeth should be realined to a normal axial inclination, in a series of angles. The apices of these angles are directed forward so that the resultant force emanating from such a relationship is disseminated toward the front of the mouth. This forward propelling force is resisted and balanced by action of the muscles of the lips and cheeks in exerting a strong pull in a distal direction on the denture and its basal supports.

The radius of the mandibular curvature should be equal to the length of the radius of the maxillary sphere. The back-

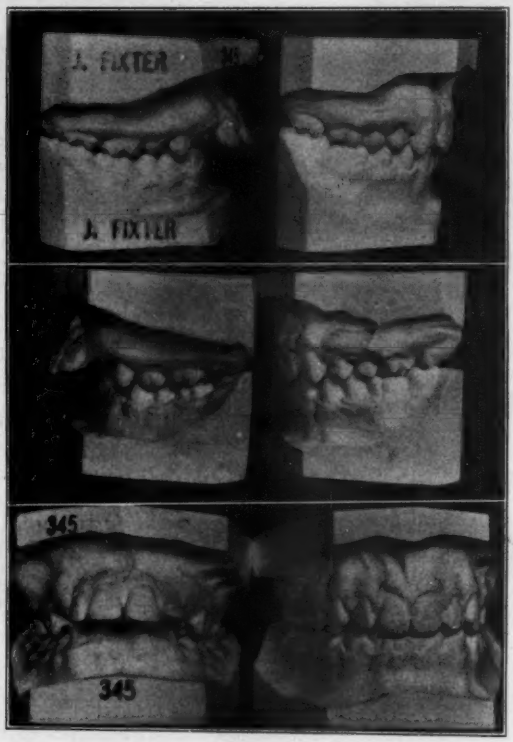

Fig. 14.—Results obtained by routine Angle Class II treatment.

ward thrust on the mandible is eliminated by changing the axial inclination of the teeth and the establishment of spherical congruency of the maxillary and mandibular spheres. The mandibular molars should be moved or tipped to a position of correct axial inclination, and the premolars should be elevated and the incisors depressed. Stationary anchorage should be maintained in the lower jaw, and the maxillary teeth should be tipped distally until the normal inclined-plane relationship is established.

1. Move the maxillary molars, deciduous molars or premolars and canines distally until normal inclined plane relationship with the mandibular dental arch units is established. This movement, like all other tooth movements, should be overdone at the time of treatment for there is always some springing back when the active appliances are removed which will carry the teeth into the relationship that is desired.

2. Move the maxillary central and lateral incisors lingually, labially or distally, as indicated by the division of Class II under treatment.

Fig. 15.—Distally inclined relationship of lower denture in hypertonicity, with functional movement in lateral ranges practically prohibited.

I have tried various methods of treatment, and the plan of management advocated by Angle has proved to be the most effective.

A complete three-dimensional analysis of the malocclusion and a study of all the related etiologic factors will indicate the plan of treatment to be followed. Quoting from Dr. Strang's "Textbook on Orthodontia," the plan advocated by Dr. Angle is as follows:

3. Establish *a stationary anchorage on the mandibular arch and guard this zealously.* The object of this stationary anchorage is to prevent labial tipping of the lower incisors, and mesial axial perversion of the lower canines, premolars and molars. These teeth are already mesially inclined and it is due to this perversion that the functional forces have retarded rather than stimulated mandibular growth. Consequently failure in anchorage would simply exaggerate the already perverted stresses of occlusion.

4. Correct the infra- and supraocclusion of the various arch units, as indicated in the case analysis.
5. Effect general arch growth, as needed.
6. Reestablish normal growth, functional activity and muscular balance and harmony in all the associated tissues.

Figure 14 indicates the results obtained by routine Angle Class II treatment.

In Class II, Division 2, cases there exists a hypertoned, tense musculature of the lips. Owing to the hypertonicity of the muscles of the lips and cheeks, there exists a greater perverted functional activity, in that these muscles exert a definite backward driving force on the whole denture. The forward development of the mandible seems to be checked by a lack of adequate vertical development and the lingual inclination of the maxillary incisors that are in supraversion. It would seem that the hypertoned musculature exerts a restraining action on the central incisors, and they are not able to assume their normal inclination. The lower denture, as a result, assumes a distally inclined-plane relationship, and functional movement in the lateral ranges is practically prohibited. (Fig. 15.)

Mastication in the type of malocclusion shown in Figure 15 is a "ticket punch" or open-and-shut hinge-type motion. The flat plane of occlusion and the abnormal overbite prevent a shearing or incising action in the ranges of mastication. In these cases, there exists a greater bulk of mentalis muscle, and the swallowing function is an abnormal sucking action. In most cases, lateral development of the mandible appears to be fairly good in the molar region. In the incisor area, the mandible is narrow, and the incisor teeth are often bunched or malalined. The mandibular teeth are oriented to an almost even horizontal plane, and there is no tendency toward an excessive mesial-axial inclination of the lower molars.

In Division 1, the perverted mechanical forces of occlusion produce a posterior thrust on the mandible. In Division 2, distal thrust is not so evident during function, except that the maxillary molars are in disto-axial inclination. Close examination of the buccal musculature and facial lines indicates a lack of vertical growth in the molar and premolar areas of the denture.

The associated etiologic factors constitute a factor in the developmental processes resulting in inadequate vertical growth in the molar and premolar regions. The abnormal sucking action and the hypertoned abnormal musculature produces distal pressure on the anterior portion of the dentures, and retardation of growth in the maxillary incisor area effects a distal inclined-plane relationship of the mandibular molars. Abnormal function, as a result, prevents a forward growth of the body of the mandible. Each case demanding treatment is an individual problem, and the regular Angle Class II treatment of both divisions has, in my hands, been the most effective.

Retention is a difficult problem in Division 2 because of the difficulty encountered in the maintenance of vertical growth in the molar and premolar areas. The Hawley bite plane retainer and the maxillary arch worn over a long period of time, or until full body growth has been completed, have been the most effective means of retention.

The main purpose of this paper is to indicate the importance of thorough case analysis. Adequate analysis of the problem from all possible avenues of approach will indicate the need for certain methods of treatment management. A fundamental knowledge of the growth and development of the denture and the coordinated functional relationship of all component parts is the basic requirement for the practice of orthodontia.

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DENTISTRY AND SOCIALIZED HEALTH SERVICE

THE National Health Conference, held in Washington, D. C., July 18-20, 1938, signalized the first publicly announced definite step of the present administration toward the adoption of a nation-wide program for rendering medical service to the indigent as well as to all other classes who are unable to bear the expense of adequate medical and dental service.

The so-called conference was, in reality, not a conference in the sense of considering the various views of the interests present; it was more of an informative meeting in which the administrative authorities, welfare worker representatives, social workers and semi-governmental departments informed the medical profession and allied health bodies that the government had decided upon a plan of socialized medicine which, after the inclusion of some final details, was soon to be put into operation,

and, inferentially, without special consultation or consideration of the organized health professions.

This procedure was impelled by the fact that the medical profession, from the very beginning of the agitation for a system of socialized medical service, had refused to acknowledge that present medical service was in any sense inadequate or defective and therefore had flatly opposed every suggestion of change or modification of medical service and had particularly opposed any suggestion from the government to conform medical service to the socialistic trend of the present administration.

The conclusions of the conference, if followed to a finality, would prove disastrous to all previous medical thought, tradition and practice.

The reaction of the organized medical profession to the conclusions or, rather, purposes of the so-called conference was the convening of a special meeting of the House of Delegates of the American Medical Association to consider and determine the future policy of the medical profession as to the proposed plan. The seriousness with which the situation was viewed is indicated by the fact that this is the third time in the history of the American Medical Association that a special session of the House of Delegates has been called.

The result of the two-day special session was revision of its plan of action, amounting practically to reversal of its previous position, with a declaration of principles conforming more nearly to the principles laid down by the Health Conference, and the appointment of a committee empowered to act in a consultative capacity with the governmental authorities, whose duty it is to perfect a plan of service that will provide adequate medical service to all classes in accord with the socio-economic ideas of the present administration.

On the whole, dentistry has been inclined to follow the lead of medicine in its attitude toward socialization of health service, recognizing the fact that dentistry would necessarily be included in any plan of nationalized medical service, even though dental practice differs widely from medical practice. We have, however, in some respects adopted a more cooperative attitude toward efforts to change the character of dental practice, not with any more sympathetic attitude toward socialized dentistry, but with a more sympathetic attitude in the matter of helping the health authorities in determining the relation which dentistry should bear toward a revolutionary change in health service. And on the several occasions when representatives of the American Dental Association have met with the governmental representatives who are directing social

security health service, the former have been assured that dentistry would be extended every inherent privileged prerogative in designing any health service program.

To be reassured of this prerogative, however, a special committee of the American Dental Association, still acting in collaborative spirit with medicine, considered the recommendations of the Technical Committee on Medical Care made to the National Health Conference and presented a declaration of principles to be offered by the Association to the Federal Government for its guidance in planning the dental phase of a general health program. The principles involved and the recommendations relating to them are published in full in the present issue in another department.

We are in full accord with the spirit of the principles and recommendations relating thereto, and we are most hopeful that the recommendation of the Committee, soliciting special attention to developing ways and means of aiding the dental profession in its search for the cause of dental caries, may receive favorable consideration on the part of the Government.

The dental profession and all others who have come in contact with this all-pervasive disease have long since concluded that the problem of caries etiology cannot be solved by dentistry alone, but that it must be solved by a united cooperative effort on the part of scientific workers in practically every biologic field. And it would seem that, in the consideration of a health plan that would serve best the greatest number, probably the most effective and wide-spread results could be attained in the solution of the cause of the most wide-spread disease of mankind —dental caries.

If that one desideratum can be brought about as the result of governmental study and interest in public health, a notable health benefaction will have been conferred upon suffering humanity.

Early in the agitation for socialized medicine, organized dentistry declared itself opposed to any form of socialized dentistry, and we believe the profession as a whole is still opposed to it; but, in the light of later developments, mainly the apparent determination of the government to institute a system of socialized health service, dentistry has modified somewhat its position and has assumed a more cooperative attitude toward the whole question.

The principles laid down by the Technical Committee of the National Health Conference are in essence those long approved by both the med-

ical and dental professions, the one serious difference being the attitude toward compulsory health insurance. The professions see in this the potentiality of political domination and influence in the administration of a general health service, and the experience of other countries proves that we are warranted in viewing with alarm the adoption of such a system.

In an effort to safeguard the interests of medicine and assure its administration free from political influence, the House of Delegates of the American Medical Association has declared itself as insisting that the service be administered by a health department established by the government and under the supervision of a medical man who shall be a member of the President's Cabinet. The American Dental Association, through its House of Delegates, approves and supports the action of the American Medical Association, with the added modest and reasonable provision that the secretary or one of the secretaries of the chief administrator shall be a dentist. The medical profession also insists that the personal relationship of physician and patient, a feature of medical practice that has contributed largely to its success in the past, be not disturbed by any changes in the character of medical practice. The dental profession is equally insistent upon this condition, as the successful practice of dentistry is equally, if not more, dependent upon this important relationship.

These few demands from two of the leading health professions appear to us to be quite modest in view of the revolutionary changes possible and predicted in the application of health security as a part of social security, and we are confident that those in authority will see the wisdom of including these provisions as the basis of united health service.

For our part, we do not feel any great anxiety as to the outcome of this issue. We have an abiding faith in the integrity and honesty of purpose of the great American body politic, and we look forward confidently to the solving of this problem in the same satisfactory manner as numerous equally serious problems of American social life have been met and solved since the days of the Pilgrim Fathers.

In the Economics Department of this issue, Dr. Lon W. Morrey presents a historical sketch of the various events leading up to the present status of health security, which is certainly first-hand information on the development of an issue that is most vital to every medical and dental practitioner.

THE ST. LOUIS MEETING

THE recent Session of the American Dental Association, held in St. Louis, October 24 to 28, will pass into the history of dentistry as a successful meeting, featuring the most important phase of dental practice —prevention.

Since we have not yet succeeded in completely solving the etiology of dental caries, we have become somewhat reconciled to attacking the disease from the nearest practical preventive approach, namely, control of caries in the mouths of children. The slogan adopted by the President, Dr. C. Willard Camalier, "Dental Health for American Youth," had for its objective the application of practical measures of correction and control of dental caries at the earliest possible age of the child.

As an adjunct to the promotion of youth health, an extensive health poster contest was inaugurated during the past year by the American Dental Association in the public schools throughout the country, and the interest created was productive of one of the most remarkable exhibitions of the ingenuity of youth in portraying reactions to the health lessons taught. "Youth Lane," lined with dental posters prepared by the children of the whole country, furnished a most vivid example of the benefits that can be directly derived from intelligently conceived and properly directed efforts toward mouth health; which further confirms our belief that dental education of the public can most hopefully be prosecuted through the education of children. The results so graphically portrayed at St. Louis certainly seem to warrant further and intensive efforts along this line.

The meeting in all its phases was well up to the high standard set by recent previous meetings and demonstrated a perennial interest in dentistry that is apparently unabated even through a period of depression which seems exasperatingly slow in receding. The attendance was well over the eight thousand mark and the facilities for holding the meeting seemed ample even for such a large body.

The General Meetings were more largely attended than those of other Sessions, and the Section Meetings were equally well attended. In accord with the theme of the meeting as embodied and publicized in Dr. Camalier's slogan, "Dental Health for American Youth," the Section on Children's Dentistry and Oral Hygiene received most interested attention and the program of the Section was well conceived to support the other phases of preventive dentistry.

The Section on Oral Surgery, Exodontia and Anesthesia, as has been the case for a number of years, drew very large audiences at every session, and the interest shown in these phases of practice appears unabated. As a natural corollary in its sequential relation to oral surgery and particularly exodontia, the Section on Full Denture Prosthesis was quite as popular and well attended. Although marked attention was given the scientific program offered in the Section on Full Denture Prosthesis, even greater interest was exhibited in this subject in the sessions of the American Society of Dental Prosthetists, a meeting held previous to but in affiliation with the Annual Session of the American Dental Association. Several other groups of specialists of dental practice held meetings previously to the Annual Session—all apparently tending more strongly toward emphasis on specialization and also leading inevitably toward the elimination of the general practitioner, a result which has become a fact in the medical profession, to the distressful anxiety of the majority as to the future of medicine, particularly now that socialized medicine seems so evident in the offing.

In the Section on Orthodontia, a phase of dental practice that has been almost completely isolated from general practice by specialization, the interest seemed to be maintained to the usual degree. In this department of dentistry, there is apparent a peculiarly paradoxical situation, in that even though it is a distinct specialty, more interest is being manifested in the subject year after year by the so-called general practitioner, and because of the apparent impossibility of separating this subject entirely from the aims, purposes and objects of dentistry practiced from the biologic aspect.

In St. Louis, facilities for holding a large dental meeting are unsurpassed, the magnificent Municipal Auditorium providing ample space for every phase of the meeting and under one roof.

The Local Committee, under the efficient chairmanship of Dr. Oather A. Kelly, left nothing undone that could possibly contribute to the comfort and pleasure of the entire meeting. Entertainment, personal comfort and scientific pabulum were all equally well provided by the Committee, and the eminent success of the meeting may be attributed directly to the capable and unselfish manner in which this group cared for all who attended.

The Scientific Exhibit was by far the most extensive and the most interesting of all dental meetings yet held. Under the direction of Dr. George B. Winter, this phase of the annual meeting has developed an

educational potentiality that is as highly appreciated as it is creditable. While there were several distinctly unusual exhibits, we prefer to consider the exhibit as a whole, and, thus considered, it stood out conspicuously as one of the most attractive and interesting phases of a great meeting.

There was one particular phase of the St. Louis meeting that was outstandingly and conspicuously notable from the educational viewpoint, and that was the character of publicity given to the meeting in the newspapers of St. Louis. Each day, all the newspapers in the city contained extensive accounts of the convention of a dignified professional character that was most favorable to dentistry—and practically all, we believe, attributable to the high type of men on the Local Committee and practicing in St. Louis.

The incoming administration will have a high example of attainment to surpass in staging the meeting for 1939.

Altogether, the St. Louis meeting will be recorded in the history of dentistry as one of its most successful meetings, and in some respects *the* most successful up to the present.

Dr. Marcus L. Ward, Ann Arbor, Mich., becomes the President for the ensuing year, and Dr. Arthur H. Merritt, New York City, was made President Elect, with Dr. Oather A. Kelly, St. Louis, First Vice President; Dr. Percy C. Lowery, Detroit, Second Vice President, and Dr. J. O. Hall, Waco, Texas, Third Vice President. Dr. Harry B. Pinney, Secretary, and Dr. Roscoe H. Volland, Treasurer, were re-elected for the coming year.

Milwaukee was selected as the place of meeting for 1939.

A.D.A. CHRISTMAS SEALS

THE report of the Secretary of the Dental Relief Fund Committee, Dr. E. E. Graham, Chicago, just issued, is one that brings encouragement to those dependent upon the generosity of their fellows, and as well brings the satisfaction of deeds well done to those who have contributed to the Relief Fund.

The Relief Fund in the year just passed has been augmented by some $23,000, mainly through the generosity of the members of the Association in purchasing the Christmas Seals, and although this is a substantial

increase over the amounts added in previous years, the demands upon the fund have been proportionately increased, so that it again becomes desirable to appeal to the generosity of spirit that is impelled by the Christmas Season.

The number of those so unfortunate as to require help from the Relief Commission has increased from twenty-three in 1934 to fifty-seven in 1938, and while these increased demands have been met in full measure, it becomes necessary to urge freer and larger donations in anticipation of future needs.

This activity of the American Dental Association is one that brings a large measure of pride to all who are familiar with the good accomplished, and the spirit of sincere appreciation embodied in the expressions of the recipients of this benevolence is more than sufficient to recompense the "givers" a hundredfold for their generosity.

None can predict trouble, misfortune and calamity except within the expectation of the frequency of repetition of the past, but to be prepared even in that measure brings a feeling of security that is most satisfying.

We appeal to every member of the Association to be at least as generous in his contribution to the Christmas Seals fund this year as he was last and increasingly so as his circumstances may permit.

A new feature of the Relief Fund project, and one with which all members may not be familiar, is provision for loans in case of disasters not provided for through ordinary insurance.

We know of no place where a dollar or two dollars, or even more, brings a fuller satisfaction to the giver than does the annual contribution through the Christmas Seals.

DEATH OF DR. A. W. CROSBY

It is with much sadness that we announce the death of Dr. Albert W. Crosby, New Haven, Connecticut, which occurred on November 11. An obituary of Dr. Crosby will appear in a later issue of The Journal.

OBITUARY

URA GARFIELD RICKERT

(1879-1938)

URA GARFIELD RICKERT, D.D.S., M.S., F.A.C.D., professor of diagnosis, dental therapeutics and radiology in the College of Dentistry, University of Michigan, Ann Arbor, died in Chicago on the eve of his fifty-ninth birthday, October 22, 1938. His death came suddenly, wholly without warning, while he was enroute to St. Louis to attend the meeting of the American Dental Association there. Passing the time betweeen trains, Dr. Rickert entered a moving picture theater, where, sitting alone in a rear seat, he apparently fell asleep and peacefully passed away. The physician's diagnosis was chronic myocarditis.

Born in Wadsworth, Ohio, October 22, 1879, he obtained his early education in Wadsworth Normal College and in Buchtel Academy and College, from which he received the degree of bachelor of science. After graduation, he became superintendent of schools in Atwater, Ohio, and he later taught science in the high schools at Alpena and Marshall, Mich. In 1912, he entered the University of Michigan for work in organic chemistry and bacteriology, and here he received the degree of master of science.

His interest was then directed to research in the problems of dentistry. Under a research grant, he began his studies of biochemical problems in that field and, at the same time, he was enrolled in the school of dentistry, from which he was graduated in 1916. He remained in the school as a member of the teaching staff and continued his researches, in which he was active until his death.

Perhaps his outstanding contributions in research were in the field of dental infections in their relation to systemic disease. He was a keen student of the borderline between medicine and dentistry and a recognized authority on the diagnosis of general diseases arising from a dental source. During the wave of enthusiasm for the wholesale extraction of teeth for the relief of systemic disturbances, his conservative teachings played a large part in stabilizing thought and practice in this regard.

His kindly nature and broad humanitarian interests enabled him to give wise counsel in many important projects. As a member of the council of the state dental society, the Advisory Council of the Michigan State Department of Health and the Council on Dental Therapeutics of the American Dental Association, he rendered in each of these fields outstanding service and exerted a strong directional influence.

He had served the Michigan State Dental Society as president and was a past president of the International Association for Dental Research and past president of the American College of Dentists. For a number of years, he had been associate editor of the *Michigan State Dental Journal* and he was a member of the board of editors of the *Journal of Dental Research,* the American Association of Dental Editors and the committee appointed in cooperation with the United States Public Health Service. In 1931, he made a study of the social economic conditions affecting the professions of medicine and dentistry in Europe.

Dr. Rickert was elected to membership in the following honorary societies: Phi Kappa Phi, Sigma Xi and Omicron Kappa Upsilon. He was a member of the American Association for the Advancement of Science and the American Society of Bacteriologists and a Fellow of the American College of Dentists, of

which organization he was president in 1931.

Dr. Rickert's interests and activities were not confined to the school in which he taught, but were also directed toward the larger interests of dentistry everywhere. His wide reading, his world travels and his scientific researches gave him a fund of information which made him an interesting speaker. Through his numberless public appearances before dental, medical and lay audiences in practically every section of this country, he wielded a strong influence in shaping both professional and public opinion regarding dentistry as a health service. He will long be remembered by a host of those within and without his profession who honor him for the wise council, sound teaching and friendly interest which he so freely and so willingly gave.

U. GARFIELD RICKERT, D.D.S., M.S., F.A.C.D.
(1879-1938)

Dr. Rickert was married in 1910 to Miss Gertrude Lillian Burroughs, who, with a son, a brother and two sisters, survives him.

RUSSELL W. BUNTING.

COUNCIL ON DENTAL THERAPEUTICS

URA GARFIELD RICKERT

THIS is the Council's tribute to a distinguished colleague. Words cannot express the value of his services to his profession, or our sorrow at his passing.

Since the organization of the Council on Dental Therapeutics in 1930, the services of three of its original members have been lost because of a demand for their labors in other fields. Now another member has been called away, this time by the Almighty.

In the passing of Ura Garfield Rickert, the Council has lost one of its most earnest and enthusiastic members. He labored untiringly to encourage the practical application of the work of this Council and to place dental therapeutics on a rational basis. His talent for speaking convincingly and energetically particularly fitted him for the dissemination of information so vital to professional progress. Despite heavy curricular and extra-curricular activities in conjunction with his university work, he grasped all opportunities to further the work of the Council. He contributed liberally to the preparation of Council reports. His advice in formulating Council policies has been extremely valuable, and his honesty and sincerity of purpose won for him the admiration and respect of his colleagues on the Council and in the profession.

It is the way of the world that one bears a load for a time, and when he perforce lays it down, someone else may pick it up and, in his manner, carry it on. But the vacancy left by the passing of a friend and trusted conferee is never filled. So the members of the Council mourn the departure of one of them and keenly feel the vacancy that is created.

Dr. Rickert was an educator and a leader who selected the "high road of life" that he might serve his profession well and through it that he might contribute to the well-being of man. Than this, there is no worthier purpose in life. By loyal devotion to the promotion of higher professional ideals, his life exemplified the Council motto, "We serve not for ourselves but for dentistry." In his passing, the Council bows its head in appreciation of a loyal friend whose services to its cause were well and faithfully administered.

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Dentifrices*

Simplicity Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, page 117).

*A.D.R. 1938, p. 112.

Manufactured by The Sheffield Co., New London, Conn. Distributed by The Dayton Company, Minneapolis, Minn. No U. S. patent or trademark.

Stratford Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, page 117).

Manufactured by The Sheffield Co., New London, Conn. Distributed by Recorg Supply Corporation, Chicago, Ill. No U. S. patent or trademark.

Eureka Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, page 117).

Manufactured by The Sheffield Company, New London, Conn. Distributed by Eureka Tea Company, Chicago, Ill. No U. S. patent or trademark.

Local Anesthetics†

Solution Procaine Hydrochloride 2% with Neosynephrin Hydrochloride (Stearns) 1:3,333-Proco-Sol Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; neosynephrin hydrochloride (Stearns), 0.00033 gm.; sodium bisulfite, 0.0019 gm.; cresol, 0.2 per cent; sodium phosphate dibasic, 0.002 gm., and Locke-Ringer's solution, 0.5 cc. in distilled water.

Manufactured by Proco-Sol Chemical Company, Inc., Philadelphia, Pa. No U. S. patent or trademark.

Solution Procaine Hydrochloride 2% with Neosynephrin Hydrochloride (Stearns) 1:3,333-Proco-Sol Brand in Cartridges, approximately 2.5 cc.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information on the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

†A.D.R. 1938, p. 36.

VINCENT'S INFECTION*

VINCENT'S infection is described in the literature under the following terms: trench mouth, ulcerative stomatitis, Plaut's angina, Plaut's ulcer, Plaut-Vincent infection, acute oral spirochetosis, acute ulcerative gingivitis, *cancrum oris,* ulceromembranous stomatitis and ulceromembranous gingivitis. Undoubtedly, other names may have been proposed, but this list is fairly representative.

This is an infectious disease of the oral mucosa, usually acute but sometimes chronic, characterized by fetor, ulceration, swelling, tenderness of the soft tissues, gomphiasis, cervical adenitis and salivation.

Oral organisms usually exhibit little or no specificity. Rather, they are opportunists. Thus, even in a mouth which has had diligent and effective prophylactic treatments by dentist and patient, organisms exist without causing local or systemic infection. On the other hand, when a cover glass smear made from turgid, hemorrhagic, grayish slough-covered gingivae contains fusiform bacilli and spirochetes in great abundance, the diagnosis probably is Vincent's infection. When these organisms do not predominate in the field, other diseases must be considered. The two organisms are found in symbiosis, and although pleomorphism has been suggested as an explanation for this phenomenon, the point remains unsettled. Furthermore, since *Borrelia vincentii* and *Treponema pallidum* are morphologically similar, serologic tests may

*Presented as one in the Council's series on pharmacology and therapeutics.

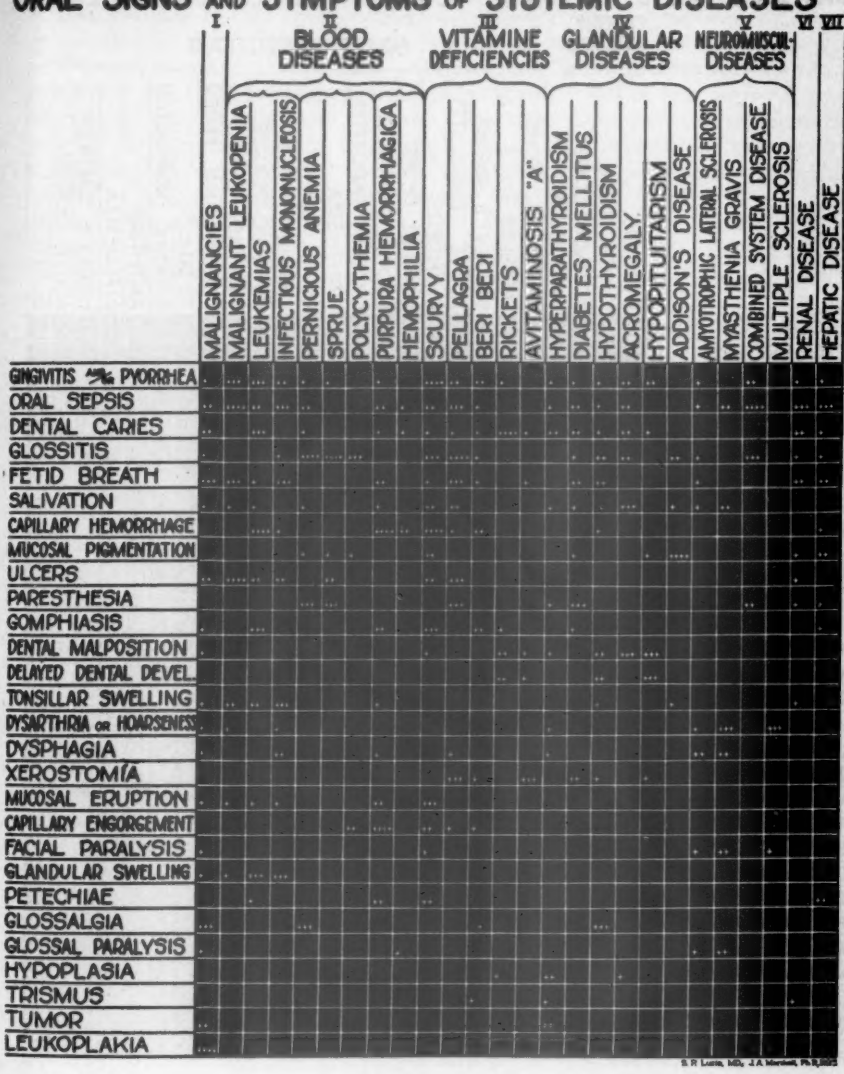

Figure 1.

be necessary to determine a possible syphilitic infection. Culturally, Vincent's organisms are saprophitic anaerobes, which frequently enter as secondary invaders of previously debilitated tissue.

Efforts to produce Vincent's infection experimentally have not been completely successful. A predisposition to Vincent's infection has been produced in dogs by injections of sublethal doses of scillar-

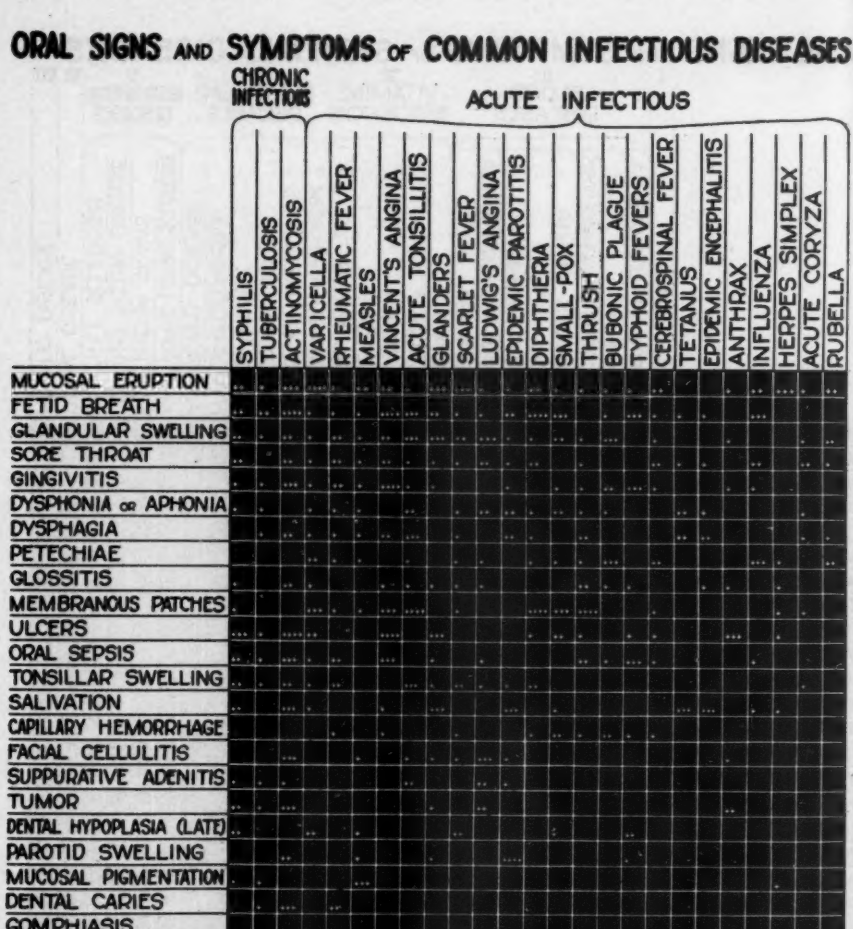

Figure 2.

en-B.[1] When traumatic ulcers were produced in the mouths of guinea-pigs, Vincent's organisms were constantly found in the smears on the membranes which formed over the ulcers. Neither topical nor parenteral use of arsenic compounds reduced the organisms in the field. These data, together with the statement that in many cases of Vincent's infection, recovery ensues apparently with-

out treatment, tend to throw doubt on the relationship of Vincent's organisms to the disease.[2]

The characteristic local signs and symptoms are fetor, necrotic gingivitis, ulceration, oral sepsis and mucous patches. Of lesser importance, diagnostically, are gomphiasis, mucosal eruption, glandular swelling, sore throat, dysphagia, salivation and capillary hemorrhages. The general symptoms are fever, malaise, constipation, restlessness, headache and loss of appetite. The first symptom is a marked redness of the gingival crest and oral sepsis, followed usually within twenty-four hours by gingival swelling and pain. Soon ulceration, fetor and adenitis supervene. As the disease progresses, gomphiasis, dysphagia, salivation and hemorrhage develop, concurrently with the general symptoms.

Age incidence is insignificant, as any individual from childhood to senescence may contract the disease. However, the young adult is more susceptible than the infant or the edentulous. Infrequently, a case is observed in an edentulous mouth where a recently treated infection (e.g., erysipelas) is followed by reddening and extensive swelling of the gums, which are partly covered with a grayish slough. Neither the wearing of artificial dentures nor misdirected therapy is responsible for the exacerbation. No racial immunity has been observed, nor does climate enter directly into the pathogenesis. Similarly, the incubation period is unknown for the reason that a subclinical infection may exist for months before definite signs or symptoms develop. On the other hand, when the disease is acute, the patient reacts within two or three days from the time of infection. The severity of the symptoms may be lessened after from seven to ten days and the disease change to the chronic form. The latter are the borderline cases, so difficult to recognize and to cure.

The following diseases have oral signs and symptoms sufficiently similar to Vincent's infection to complicate the diagnosis and to emphasize the necessity for accurate observation and careful clinical judgment: syphilis, actinomycosis, smallpox, varicella, acute tonsillitis, diphtheria, glanders, typhoid fever, influenza, scurvy, malignant leukopenia, leukemia, pellagra and beriberi.

On account of the similarity of oral symptoms of Vincent's infection to those of some of the blood dyscrasias, particularly malignant leukopenia, it is frequently advisable to have a blood count made. This procedure is of great importance, especially if arsenic therapy is contemplated.

The relative severity and occurrence of the oral symptoms of systemic diseases have been presented in chart form by Lucia and Marshall.[3] (Figs. 1 and 2.)

Prognosis is usually favorable, provided the patient cooperates fully with the dentist. If the treatments are discontinued too soon, recovery is slow. In patients of greatly lowered resistance, due to unhygienic living conditions, grossly inadequate diets or long-continued fevers, noma may develop. In this event, the patient usually dies in a few days. Other complications which have been reported are pleuropulmonary gangrene and infection of the accessory nasal sinuses.

Errors in diagnosis may account for the literature being overburdened with systems of therapy, often more dangerous to the patient than helpful. Although no specific drug or compound has been proved to be uniformly efficacious, there are a few which, when supplemented by careful scaling and polishing operations of the teeth, have been used with apparent benefit.

The drugs used for topical application to infected mucosa are classified as spirocheticides, caustics, oxidizing agents and bacteriostatics. Drugs for parenteral administration are restricted to the arseni-

cals. The lengthy list which follows is an indication of the difficulties encountered in the treatment. By far the greater number of patients recover without complication provided both office and home treatments are properly conducted. Failing this, the prognosis becomes less favorable and the case regresses into a chronic form. It has also been noted that although the majority of mouths clear up readily without the use of arsenic compounds, there are others which resist these drugs.

The following drugs are classified in accordance with their action:

1. Spirocheticides, or more correctly in this case, spirillicides (advised):

Neoarsphenamine, either as a topical application, from 2.5 to 10 per cent solution in glycerin, topically, or for parenteral use.

Arsphenamine 2.5 to 10 per cent in glycerin, topically.

2. Caustics (not advised):

Phenol, 95 per cent, topically.

Silver nitrate, 35 per cent, topically.

Chromic acid, 10 per cent, topically.

Trichloracetic acid, concentrated, topically.

Copper sulfate, as paste with glycerin, topically.

Zinc chloride, 10 per cent, topically.

3. Oxidizing agents (advised):

Hydrogen peroxide full strength and/or diluted as a mouthwash, topically.

Aromatic chlorazene powder, as a mouthwash.

Potassium permanganate 1:1,000 as a mouthwash.

4. Bacteriostatics (advised):

Viogen (1 gm. crystal violet plus 1 gm. brilliant green in 100 cc. of 50 per cent alcohol, topically (daily).

Metaphen, 1:1,000 as a mouthwash.

Merthiolate, 1:1,000, 1:5,000, topically.

It is questionable whether ulcers should ever be treated with caustics, radium or x-rays. An ulcer may have a variety of causes. It may be purely traumatic, syphilitic, tuberculous or a part of the syndrome of Vincent's infection. Therefore, an ulcerated area must be studied from the standpoint of etiology. If traumatic, owing to the presence of sharp edges of badly broken down teeth or dentures, these irritants must be removed; but extraction is permitted only after the subsidence of the acute symptoms. Cautery, either thermal or chemical, merely delays healing by spreading the infection. The application of such cauterants as chromic acid, silver nitrate, phenol and trichloracetic acid, although recommended by many authors, is an unsatisfactory method of treatment.[4] Instead of caustics, a thick paste made with water and sodium perborate is applied to all ulcerating surfaces and left in contact with the gums for five minutes. It is then washed off thoroughly with warm water. This is not a method for home treatment, but must be performed in the dental office. It is well known that repeated and indiscriminate use of sodium perborate produces sloughs which are as painful as those of Vincent's infection.

Another remedy frequently advised, but, like all others, not infallible, is a solution of neoarsphenamine (from 2.5 to 10 per cent) in glycerol. This is applied to the dried mucosa two or three times daily and left for from five to ten minutes before being washed off. No harm results from accidental swallowing.

Any of the following oxidizing solutions may be prescribed as a mouthwash. The patient is instructed to rinse thoroughly for at least five minutes. In the dental office, these remedies, when freshly prepared, may be applied by the spray bottle: hydrogen peroxide, diluted if necessary with a little cold water; aromatic chlorazene powder, half teaspoonful in half a glass of hot water; potassium permanganate 1:1,000 or 1:5,000 solution, used as hot as possible; boric

acid, saturated solution, used as hot as possible.

Dentifrices containing soaps such as sodium laurate, palmitate, myristate or oleate have been used with alleged success in the treatment of the early stages. These soaps may be of greater service in prophylaxis than in curative treatment.[5]

Potassium arsenite solution, U.S.P., 3 drops three times a day, may be prescribed in obstinate chronic cases. Another remedy of some usefulness is acetarsone. The 0.25 gm. tablet is divided into fourths and dissolved in a tablespoonful of milk or water for children. For adults, from one to one and one-half tablets are used.

Smoking delays healing and should not be permitted. Diets rich in vitamins are essential.

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PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Matrix for Cervical Silicate Fillings—The ordinary penpoint makes an ideal, easily applied matrix for silicate fillings on the labial and buccal surfaces of the teeth. An assortment of sizes and curvatures can be made by bending and grinding the blunt ends of a number of points. When the proper matrix is coated with cocoa butter and held in place with finger pressure, little trimming of the silicate is necessary.—*Herman L. Goldstein, Charleston, W. Va.*

Avoiding Exposure in Cavity Preparation—In case of fracture or deep cavities in the anterior teeth of young patients where cavity preparation may cause exposure of the pulp, a celluloid form is prepared of the proper anatomic shape of the tooth and filled with synthetic porcelain of the proper shade. The whole tooth is covered in the manner of a porcelain jacket crown. After several days, the celluloid is removed by splitting with a sharp instrument.—*I. J. Liss, Houston, Texas.*

Cavity Linings—For lining cavities under synthetic porcelain fillings, much better results can be obtained by using any inlay cement in the cavity, and placing the synthetic porcelain over it. The cement should be mixed rather thin and placed in the cavity carefully, avoiding all margins. It can be introduced with an explorer or broach. It is not necessary to wait for the cement to harden, and it does not have to have any great depth because its purpose is to protect the dentin from contact with the porcelain. The

cement can easily be seen in the cavity, and if a margin is touched with it, can easily be removed. Cement has probably some advantage as an adhesive.—*James J. MacMillan, Carbondale, Pa.*

Fissure Bur—A fissure bur with the end snipped off at a forty-five degree angle and revolving quickly to minimize jarring will more readily penetrate thick enamel of teeth with incipient occlusal decay than the ordinary bur. Extension and depth of cavity can be assured with less heat generated and with time conserved. —*G. Sidney Jacks, Chicago, Ill.*

Waxing Inlays—In waxing up inlays by the indirect method or partial dentures (to be cast), a small flame to smooth out and give a fine finish to the wax is often needed. This can be accomplished by taking an old Luer hypodermic needle and attaching it to the gas jet by means of rubber tubing.—*David Waldman, 1114 De Kalb Ave., Brooklyn, N. Y.*

Pulp Protection—The pulps of anterior teeth with deep proximal and gingival silicate cavity preparations which cannot support a cement base can be protected by placing a wet paste base of dicalcium phosphate and eugenol in the deeper portion of the cavity and drying with a cotton pellet.—*G. Sidney Jacks, Chicago, Ill.*

Finishing Tissue-Bearing Surfaces—After the vulcanite denture has been polished, to give the tissue-bearing surface a luster, the surface is painted with glycerin and wiped off with cotton. This also removes small plaster particles that cling to the surface when no cellophane has been used.—*E. J. Dening, 600 Main Street, Stroudsburg, Pa.*

Capillary Attraction—"Capillary attraction" offers us a most efficient means of putting the medicines we use at the seat of the infection or irritation. With a thin, narrow blade scaler, the drug is inserted, a sufficient amount remaining on the instrument, which is then placed in the pocket or interproximate space. By capillary attraction, the medicine is carried up or down to the entire depth and seat of the pocket or crevice, without irritation or laceration of the gingiva. This method insures that the seat of infection will be reached and is superior to the application of drugs by large cotton applicators.—*Martin T. Siegel, Poughkeepsie, N. Y.*

Quick and Easy Sealing—Inlay bridge abutment preparations can be quickly and easily sealed temporarily with a mixture of surgical-pack powder, camphorated phenol and an adequate amount of thinly spatulated silicocement as a binder. The seal will adhere nicely and yet can be readily removed.—*G. Sidney Jacks, Chicago, Ill.*

Borax and Vaseline as Flux—Difficulty is sometimes encountered in getting the borax (used as a flux) down between gold backings in soldering, owing to its bubbling up. This can easily be eliminated by mixing a little vaseline with the borax, making a paste. When heat is now applied, the vaseline melts and conducts the borax down between the two backings. An excellent antiflux is a plain carbon pencil. All parts on which no solder is to flow are marked with the carbon pencil.—*David Waldman, 1114 De Kalb Avenue, Brooklyn, N. Y.*

Temporary Tooth as Gingival Protective—A temporary "tooth" built around a screw post inserted in a Davis crown root preparation is satisfactory as a gum pusher and gingival protective when made of surgical-pack powder, camphorated phenol and thinly spatulated silicocement.—*G. Sidney Jacks, Chicago, Ill.*

ASSOCIATION ACTIVITIES

RESEARCH COMMISSION

A BRIEF RÉSUMÉ OF THE RESEARCH COMMISSION'S ACTIVITIES FOR 1937-1938

By P. C. Lowery,* D.D.S., Detroit, Mich.

As chairman of the Research Commission, I wish to present a brief accounting of the Commission's stewardship for the last fiscal year. I wish also to present the federal government's personnel and our Fellows at the National Bureau of Standards, who are conducting research and investigations on dental materials used in restorative work. These men are responsible for the technical phases of our program at the Bureau. The Research Commission's contribution to the program is largely one of administration, involving, of course, maintenance of the contact with the Bureau of Standards, establishing our policy on the use of trade names, relationships with manufacturers and other similar items of an administrative character. This system has functioned smoothly and has been very effective in promoting our program.

When I was appointed to the Commission, nearly all of its funds were devoted to aiding biologic research and it was receiving approximately $35,000 annually; i.e., $1 from each member of the Association. Our funds have been gradually encroached on since the Fellowship at the National Bureau of Standards was established in 1928, with an appropriation of about $5,000. While our funds were shrinking, the work of the Fellowship was expanding and becoming more highly popular because it was filling a long-felt want on the part of the profession. Today, approximately 85 per cent of our available funds is being used for physical research at the Bureau. Instead of the $5,000 initial allocation to the Fellowship, our disbursements last year were $13,500, and in place of one Fellow, we now have four Fellows at the Bureau. This reversal of the trend of the Research Commission's program from biologic research to almost entirely physical research was caused by a number of conditions, among which were (1) the inability of the biologic workers to show immediate practical application of their findings, or to make any appreciable progress in controlling dental caries other than with the usual physical therapy of replacing lost hard and soft oral tissues with inert materials, and (2) the feeling among many members of the governing bodies of the Association that the Research Commission having "infected" many of

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*Chairman of the Research Commission.

the dental schools with a research program, continuance of aid from the Association was unnecessary. Many influential members of the Association believed that the profession should revise the ideal of G. V. Black and have some method of control over the quality of materials which they were using. As a result of this attitude, the American Dental Association, through its Research Commission, established the A.D.A. Fellowship at the National Bureau of Standards to exercise some supervision over the production of dental restorative materials, just as the Association had established the Council on Dental Therapeutics to carry out a similar program in the field of dental drugs, antiseptics and kindred materials. The Association established these two agencies during the same year.

The Research Commission believes that their present program is not in balance, has, in fact, believed so for a number of years, but has not been able to secure funds for advancing the biologic phase as it has wished. It is slowly rectifying this condition, and this year the Advisory Committee on Research in Dental Caries was reorganized and is functioning progressively. The personnel of this committee is as follows: Daniel F. Lynch, Washington, D. C., secretary of the Research Commission; Charles F. Kettering, Detroit, Mich., vice-president of the General Motors Corporation and director of its research division, and William J. Gies, of New York City, who for many years has been active in dental research and educational circles. These men are serving as chairman, counsellor and secretary, respectively. The function of this committee is to collect and correlate the known facts and theories regarding the cause and prevention of the most widespread of all human diseases, the decay of teeth. Dr. Gies is in active charge of this effort. This is to be our first inning in a renewed and intensified program of biologic research.

Dr. Gies, emeritus professor of biologic chemistry at Columbia University, and Wilmer Souder, principal physicist of the National Bureau of Standards, are rendering a public service by devoting their talents and energies to problems confronting our profession. The Research Commission is indeed fortunate to serve as a medium through which these men can function. Dr. Kettering has been very helpful with his council, and we are hopeful of interesting him in dental service.

One of the reasons that the work of the A.D.A. Fellowship at the National Bureau of Standards is so effective is the fact that it is authoritative, and the reason it is authoritative is the Bureau itself. The National Bureau of Standards is recognized the world over as an authority on applied physics and chemistry. And, after all is said and done, correctly applied physics and chemistry of dental materials is the essence of our program. Our experience at the Bureau has convinced us that the most effective method of employing our projected funds for biologic research is to spend it all in one place, in an institution which is considered one of the world's finest research centers on disease, the National Institute of Health, in Washington, D. C. The National Institute is the research arm—perhaps one had better say body—of the United States Public Health Service. It is therefore the present aim of the Commission to establish an A.D.A. fellowship for the investigation of dental disease at the National Institute of Health. We are going to start modestly by asking the Association for an initial appropriation of $5,000. The institute will match our contribution to any respective program, as the Bureau of Standards has done.

Our grant to the University of Louisville was terminated on the death of Theodore B. Beust.

The Commission has been supporting worth while and very practical research on the effectiveness, selection and use of local and topical anesthetics and neces-

sary agents. These investigations have been carried out under the direction of M. L. Tainter, of the College of Physicians and Surgeons at San Francisco. The Commission is recommending that this worthy project be transferred to the Council on Dental Therapeutics.

The testing program at the Bureau is largely conducted by our associates Mr. John R. Beall and Mr. H. J. Caul. This program consists of subjecting materials which are certified to the Commission by the manufacturers as complying with A.D.A. standards to specified tests to determine whether they comply with the quality requirements. If the materials are found to comply with the A.D.A. specifications, they are placed on the "List of Certified Products," which is periodically published in THE JOURNAL under "Association Activities." Products on this list are not only tested when they are placed on the list, but are also retested from time to time. Last year, complete surveys were made on the lists of wrought gold wires, zinc phosphate cements and amalgams. Because of this "police" testing, the manufacturers are more careful and alert in their testing than they might otherwise be. All of our tests on certified materials are made on products obtained in the retail market by dentists. No doubt, our secretary, Dr. Lynch, has called on some of you present here today for this service of obtaining samples for our tests.

The work on silicate cements has been well received by dentists, dental educators and research men, both in dental manufacturing establishments and in research institutes entirely foreign to the dental field. In the November issue of THE JOURNAL is a list of silicate cements which were found to comply with the new A.D.A. standard for these cements. For the first time in the history of the dental profession, we now have a working guide to the quality of silicate cements. Do I need to ask "Is this work worth while?" This is by no means the sole benefit of the program of research and investigation on silicate cements: as the result of this work, cements are now made with a more appropriate and a known translucency, less solubility, less tendency to discoloration and smaller arsenic content. In fact, there is scarcely a silicate cement in this country that has not been changed for the better as a result of this investigation. Our program for better dental materials is not a fancy —it is a fact.

As the colloidal impression materials become better understood, they will, I believe, be more commonly used as impression materials because of their exact accuracy in reproducing all surfaces of the teeth and adjacent tissues, and because of the ease and speed with which they can be used. In addition, they are comparatively pleasant to the patient. Dr. Paffenbarger, senior research associate, presents the findings on these materials.

Mr. Sweeney, one of our associates at the Bureau, has devoted practically all of his time for the last three years to the investigation of denture base materials. This research has been responsible for a decided improvement in the physical properties and usefulness of our synthetic substitutes for vulcanite.

Dr. Schoonover is employed by the federal government and devotes all of his time to problems relating to dental materials.

We are also continuing our extensive program of cooperation with dentists. This program is largely educational, both to us and to the dentists. Last year's committee of dentists, including faculty groups from twenty-one dental colleges, conducted a series of experiments showing the effects of variations in technic on the physical properties of the silicate cements, and also showing the differences among various brands of cement.

In considering the Research Commission's relationship with the manufacturers, it is essential first to consider the

great change that has occurred in the field of dental materials. The status has been reversed. At first, the manufacturer set the standards of quality for dental materials and did the developing on testing methods. Of course, any plant that had any testing procedure and equipment usually had methods differing from those used by other manufacturers of dental materials. They were supposed to be trade secrets as the dental manufacturing processes today are supposed to be. However, most of the testing was done unknowingly by the dentist when he clinically used the materials offered. The dentist and his patients were the test-tubes. Almost everything was done on the sole basis of trial, and error, and hope. The Bureau's technical testing and research program has resulted in the addition of suitable testing personnel and equipment by almost every manufacturer of dental materials in this country, and in many foreign countries for that matter. How was this accomplished? The government services have for a number of years been making their purchases through a procedure, whenever possible, of buying on specifications and not on trade names; that is, they now use physical and chemical tests as a substitute for reputation, real or implied, as a basis for purchasing dental supplies. Many manufacturers thought that they could make bids without testing and found to their sorrow and expense that there is a long wide chasm between guessing and testing. Many of the bids were so worded that if the lowest bidder could not supply the material, he would have to pay the difference between his bid and that of the next higher bidder, who could supply material meeting the specification. All bidders had to furnish adequate bond. You can see how guessing was liable to be an expensive process. As only a few manufacturers supplied the governmental dental services with materials, the great impetus came when the American Dental Association decided to cooperate with the Bureau in the field of dental materials. The dental profession began to ask the manufacturer for data on physical properties. The Commission made rules regarding the certification of dental materials. Every manufacturer who desired to certify his material to the Research Commission had to submit evidence that he had adequate testing equipment and personnel in his own plant or was making use of a consulting laboratory which did have. Thus the scene shifted from guessing to testing. Consult the advertising sections of our dental magazines of from ten to fifteen years ago: The difference in the appeal and in the character of these advertisements as compared with the ones of today is indeed a revelation. Swivel chair research and testing were usually the basis then; actual research and testing are now. Fancies are slowly, but certainly, being displaced by facts, and the proof is indisputably written in the advertisements. The dental profession is evolving the standards and conducting their own testing program. This is as it should be.

This reform in marketing dental materials is not the result of a general improvement in advertising. We find the same, perhaps worse, conditions in the marketing of alkalis for indigestion, cigarets for "lifts," etc. Improvements in these fields of advertising would do away with the present dangers of the development of gastric ulcers and other serious conditions from neglect in the hopes of a cure from a tablet or powder which fizzles in water.

The aim of the Research Commission has been to see that the dentist gets better dental materials and comes to know better methods of manipulating the material, which will enable him to render a better health service—the goal of our profession.

Lowery Building.

ACTION OF THE AMERICAN DENTAL ASSOCIATION HOUSE OF DELEGATES ON THE NATIONAL HEALTH PROBLEM

The Report of the Special Committee of the House of Delegates Appointed to Consider the Recommendations of the Technical Committee on Medical Care to the President's Interdepartmental Committee to Coordinate Health and Welfare Activities as Presented to the National Health Conference in Washington, D. C., July 18, 19, 20, 1938.

INASMUCH as the dental profession has long been aware that the control of dental disease is necessary to the maintenance of health, and inasmuch as the Report of the Technical Committee to the President's Interdepartmental Committee has recognized the fact that dental care constitutes an integral part of a national health program, and inasmuch as the dental profession is the only group having the training and the legal authority to treat dental disease, your Committee has drawn up the following declaration of principles and recommendations which it believes should be presented by the American Dental Association to the Federal Government for its assistance in planning the dental phase of a general health program.

PRINCIPLES

Your Committee recommends that in the formulation of any national health program, the American Dental Association should insist on inclusion of the following principles:

I. In all conferences that may lead to the formation of a plan relative to a national health program, there must be participation by authorized representatives of the American Dental Association.

II. The plan should give careful consideration to, first, the needs of the people; second, the obligation to the taxpayers; third, the service to be rendered, and, fourth, the interests of the profession.

III. The plan should be flexible so as to be adaptable to local conditions.

IV. There must be complete exclusion of non-professional, profit-seeking agencies.

V. The dental phase of a national health program should be approached on a basis of prevention of dental diseases.

VI. The plan should provide for an extensive program of dental health education for the control of dental diseases.

VII. The plan should include provision for rendering the highest quality of dental service to those of the population whose economic status, in the opinion of their local authorities, will not permit them to provide such service for themselves, to the extent of prenatal care, the detection and correction of dental defects in children and such other service as is necessary to health and the rehabilitation of both children and adults.

VIII. For the protection of the public, the plan shall provide that the dental profession assume responsibility for determining the quality and method of any service to be rendered.

RECOMMENDATIONS

Your Committee has considered the five recommendations of the Technical Committee, and, as far as they apply to dental service, makes recommendations as follows:

I. Expansion of Public Health and Maternal and Child Health Services

(A) Expansion of General Public Health Services

(1) Your committee approves of the general expansion of public health serv-

ices and, in addition, recommends the establishment of a federal department of health with a secretary who shall be a graduate in medicine, and who shall become a member of the President's Cabinet, and a first assistant secretary who shall be a graduate in dentistry.

(2) In an expanded public health program which involves consideration of the expenditure of millions of dollars for public health purposes, your Committee recommends that the problem of dental caries and of other dental diseases be included.

(B) Maternal and Child Health Services

Your Committee approves this section, provided dental care of mothers and children be included. It is, of course, understood that the necessary funds will be allocated for these services.

II. Expansion of Hospital Facilities

Your Committee recommends that due consideration be given to the inclusion of adequate facilities for dental services.

III. Medical Care for the Medically Needy and

IV. A General Program of Medical Care

(1) Your Committee is convinced that satisfactory dental service cannot be rendered under a compulsory health insurance system. It, therefore, does not favor such a plan, but it does approve voluntary budget plans under professional control which will enable patients to "apportion costs and timing of payments so as to reduce the burdens of (dental) costs and remove the economic barriers which militate against the receipt of adequate (dental) care."[1] (The word "dental" was substituted by the Committee for the word "medical" in the original quotation.)

(2) The Committee approves the recommendation that such a program should provide for "continuing and increased incentives to the development and maintenance of high standards of professional preparation and professional service."[1]

V. Insurance Against the Loss of Wages During Sickness

Considered without recommendation.

CONCLUSION

Your Committee agrees with the Technical Committee that "as progress is made toward the control of various diseases and conditions, as facilities and services commensurate with the high standards of American medical practice are made more generally available, the coming decade, under a national health program, will see a major reduction in needless loss of life and suffering—an increasing prospect of longer years of productive, self-supporting life in our population."[2] It also believes that the above statements apply equally to dental practice and that the enumerated benefits would be enhanced by early and regular dental care in childhood.

Your Committee offers two final recommendations:

(1) That, in view of the fact that dental caries is the most prevalent disease of mankind, the American Dental Association strongly recommend that the Federal Government augment, with a comprehensive research program, the efforts of the organized dental profession to determine the cause of this disease.

(2) That, in keeping with the first main principle of this report, a committee of five practicing dentists be appointed by the Board of Trustees, together with such technical advisers as the needs of the committee require, to fulfil the provisions of Principle Number 1.

COMMITTEE:

HOMER ROBISON
CRAFT A. HOPPER

1. "A National Health Program"; Recommendation 4, par. 4.

2. Ibid; Recommendation 5, last paragraph.

E. E. Voyles
Henry Cline Fixott
W. O. Talbot
Alfred Walker
Stanley Rice
R. J. Rinehart
Harold W. Oppice,
Chairman

The above report was unanimously adopted by the House of Delegates at its regular session on Wednesday afternoon, October 26, 1938. In keeping with the second final recommendation of the Special Committee, the Board of Trustees appointed the following committee of five practicing dentists: Harold W. Oppice, Chairman, Raymond M. Walls, Alfred Walker, C. Willard Camalier, Leroy M. S. Miner.

The duties of this Committee will be to act as representatives of the American Dental Association and, together with such technical advisers as their needs might require, participate in all conferences that may lead to the formation of a National Health Program. Their policies will be guided by the proposals approved in the above report by the House of Delegates.

Immediately following the approval of the report of the Special Committee on the National Health Program the Committee offered an additional resolution which was intended to increase the efficiency of the American Dental Association in carrying out the principles and recommendations adopted. This recommendation was as follows:

"Your Committee recommends that the Board of Trustees employ a dentist as a field secretary or representative to further the interests of the American Dental Association, in keeping with the principles just adopted and for such other duties as the Board of Trustees may direct."

Since this recommendation involved financial matters which must be considered by the Board of Trustees, it was moved and carried that the resolution be passed as the sense of the House of Delegates and referred to the Board of Trustees for further consideration.

COMMITTEE ON LEGISLATION

A legislative reporting service has been established by the Committee on Legislation for the purpose of conveying to all state component societies immediate information relative to any bill introduced in a state legislature that concerns in particular the practice of dentistry.

A few state societies have their headquarters in their respective state capitals or maintain there a legislative service, but the majority of the components are not so fortunate and are without facilities for insuring immediate information relative to legislative proposals in their respective states and which directly concern the dental profession.

In the coming year, forty-four state legislatures will convene in regular session and it is the purpose of the Committee on Legislation to report all state legislative proposals that affect the following:

1. Any revision of state dental practice acts.
   (a) Powers of the state dental board of examiners.
   (b) Definition of dentistry.
   (c) Licensure.
   (d) Advertising.
   (e) Practice of dentistry by corporations.
2. Alteration of the statute of limitations on malpractice.
3. Changes in the state health board affecting dentistry.

4. Legislation pertaining to health insurance and socialized medicine.

5. Changes which affect dentistry in Workmen's Compensation Laws.

6. Private and public health clinics, and dental cooperative groups.

7. Use of light and x-ray machines.

8. Initiative or referendum petitions proposed in any state.

(a) Contents.

(b) Proponents.

In the files of the Committee on Legislation at the Central Office of the American Dental Association and available for distribution will be the following data.

1. A complete list of all members of all state legislatures.

(a) House and Senate.

(b) Home towns; addresses.

(c) Party affiliations.

2. Copies of all bills that affect dentistry and its allied subjects introduced in the various state legislatures, within forty-eight hours after introduction.

(a) Name of member introducing bill.

(b) When and in which house introduced.

(c) Preliminary hearing.

(d) Disposal.

1. Tabled.

2. Voted down.

3. Passed.

4. Hearing (members of committee to which bill is referred).

5. Action of either house.

6. Action of executive.

As quickly after introduction of a bill as conditions at the different capitals will permit, the full text of each bill of interest will be in the files of the Committee on Legislation at the Central Office of the American Dental Association, with any subsequent amendments adopted during the progress of the bill through legislative consideration. The committee will be informed of each official action on the bill, so that the exact status of any bill pending in any state legislature will be known currently.

Immediately after the introduction of a dental legislative bill in any state legislature, the committee will report its introduction to the president, secretary and chairman of the legislative committee of that state dental society directly concerned, with the number and title of the bill, the name of its sponsor and the title of the committee to which it has been referred. This will be followed by a report of any action on the bill by committee or either branch of the legislature, until it is enacted or defeated.

The membership will be informed from time to time through the pages of THE JOURNAL of dental legislative trends and of the success of state dental societies in promoting or defeating dental legislation in the various states. Brief analysis or discussion of the more important legislative proposals or of court action relative to dental laws will also be published.

A summary of dental legislation for 1938 appeared in the October JOURNAL.

It is hoped this service, which will be in effect January 1939, will prove of real value to the component societies and enable them to quickly determine their policy with regard to any legislative proposal.

A. B. PATTERSON, *Chairman*
Committee on Legislation.

BUREAU OF PUBLIC RELATIONS

RÔLE OF THE DENTIST IN THE PROGRAM TO STAMP OUT SYPHILIS

By James P. Sharon,* M. D., Des Moines, Iowa

IN the present program against syphilis, volumes have been written to the general effect that this disease is the greatest killer of all the infections and that our duty to ourselves and more to the coming generations is (1) to find all cases and then to treat them adequately, and (2) to instruct our patients as to the dread effects of the disease, its early signs and symptoms, and to urge them to obtain early treatment. The campaign against this disease in one of its specific phases attempts to abolish heredosyphilis by urging serologic examination of every expectant mother. This is done by listing the various extremely disastrous effects of tardive heredosyphilis. An early invitation to the dental profession to join forces with their medical colleagues is imperative. There are about 300 cases of congenital syphilis under treatment in Iowa at the present time. Deafness, blindness, insanity, juvenile paresis and and many other conditions can be prevented in many more cases, which can be brought to treatment probably in no other way than through the cooperation of alert members of the dental profession.

It would be impossible in this paper to give in detail the many important facts regarding the numerous manifestations of congenital or acquired syphilis in the oral cavity. Some of the items enumerated would be superfluous coming from a syphilologist to those trained in this specialty. An attempt is being made not to demonstrate a knowledge of dentistry, but to develop in every practicing dentist in Iowa an attitude of suspicion as regards the prevalence of syphilis, with the end-results of protecting himself against infection and getting the patient under treatment to prevent further serious effects.

The most common sign of infectious syphilis, which should stand out like a red flag to any one working in the mouth, is the so-called mucous patch. This typical lesion of the mucous membranes is present in between 55 and 60 per cent of cases of early eruptive syphilis. It is the homologue of the macular or maculopapular lesion on the skin. The typical mucous patch is a slightly raised spot, very faintly covered by a flesh-colored to pearly or faintly grayish membrane. When this is removed, the base is seen to be clean, flat and of flesh or pinkish color; rarely with a tinge of yellow. The patch is seldom less than 6 mm. and is frequently from 7 to 10 mm., in diameter, and is comparatively painless.[1] If near a constantly moving surface, the erosion or mucous patch may be irregular, angular or stellate or may approach the stellate type. One must constantly keep in mind the markedly evanescent character of mucous lesions. Stokes says, "They may be here today

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and gone tomorrow. It is not at all impossible for a throat which on one examination presents no more than a mild angina, to be the site of a tonsillar or buccal mucous patch at an examination twenty-four hours later." The usual life of these lesions is from two to three weeks in the early secondary stage (the most infectious) of the disease.

Less common, but by no means less dangerous, is the chancre, or primary lesion, of syphilis, which occurs in the mouth with far greater frequency than is usually suspected. A classical or textbook description of an oral chancre as having a long incubation period, a period of indolence, a slow course and a satellite adenopathy would describe about 70 per cent of the chancres. Probably a less classical, but a far more practical definition would be "every sore on the lips or mucous membrane that is over 7 days old that is not proved to be nonsyphilitic." A dark-field examination repeated several times, together with serologic examinations, over a period of from three to four months is necessary to disprove the syphilitic character of such a lesion. The adenopathy, indolence, induration, painlessness and sharply defined marginations are all significant. All of them or only a few may be present, but remember it is your finger that is handling them. The fact that dentists are continually washing their hands while working in the mouth probably accounts for the relatively low incidence of extragenital chancres acquired by handling these infectious areas. Moore[2] says that soap and water, if immediately and thoroughly applied to the hands, affords adequate and complete prophylaxis against infection of this sort. This has been experimentally proved by Walker.[3]

If abrasions are present on the fingers, especially about the nails, 33 per cent calomel (mercurous chloride) ointment should be thoroughly rubbed into the hands after washing. Moore[2] calls attention to the fact that more dangerous are the puncture wounds from an infected needle or instrument recently used on a patient with syphilis. The organisms may be introduced deeply beneath the skin and will not be reached by external application. Under these conditions, the wound should be laid open to its approximate depth and the incised wound packed with 33 per cent calomel ointment and remain so for twenty-four hours. Moore[2] calls attention to the fact that similar wounds acquired in treating a patient with syphilis of more than four years' duration are much less dangerous to the operator.

Should the patient with moist lesions in his mouth cough droplet material into the dentist's eyes, the conjunctival sac should be copiously irrigated with normal saline solution. Five per cent argyrol may be dropped into the eye, although Moore[2] says its value is questionable. In the event of definite exposure, the dentist or his assistant should adopt an attitude of watchful waiting with a biweekly Wassermann test for three months following the accident.

RECOGNITION OF INHERITED SYPHILIS

An early recognition of stigmata of congenital syphilis, together with the institution of treatment by a qualified medical colleague, is a service that members of the dental profession can render, with the knowledge that, in so doing, they are preventing many disastrous effects of untreated congenital syphilis. Blindness, deafness, insanity, crippling of bodies and minds, distortion of faces are only a part of the many effects of this disease. The recognition of stigmata of heredosyphilis in its relation to the teeth is purely a problem for the dentist. Most dentists are aware of the many forms of malocclusion, chipping of teeth, wide separation of central incisors and similar nonsyphilitic conditions that, because of their unsightly appearance, are often looked on with suspicion by physicians. It is just as true that with certain teeth,

actually syphilitic, but relatively even appearing, any suspicion of syphilitic stigmata is quickly dismissed.

The ability to diagnose dental conditions that result from syphilis presupposes a knowledge of the embryology of the dental structures. According to Stein[4] and Morton C. Smith, the chief fact to be considered is that this dental condition is actually a hypoplasia and, as Stein says, it is misnamed "erosion" or "atrophy." He states that this hypoplasia is the net result of the severe disturbance of the metabolism of the young organism at the time that the dental buds and ectoderm are developing. He says that the extent of the hypoplasia depends "upon the seriousness of the disturbance, which in turn is determined by the amount and duration of the infection. He adds: "This may be so great, and the disturbance in metabolism so severe that the cells of the embryo, fetus, or young child are unable to resist it, and instead of stigmata being produced, death results." The fact must be kept in mind that in the case of Hutchinson's incisors or mulberry molars, one dental bud is absent, insufficiency of mesoderm, which later becomes dental pulp, resulting, and regardless of the size or shape of this mesoderm, the pulp will be completely covered by the ectoderm or enamel. From a more specific or practical standpoint, it must also be remembered that only the second dentition shows changes distinctive of syphilis. Stokes[1] says: "As far as the first dentition is concerned, the disease produces only those delays in eruption and defects in resistance (early decay) which are produced by other serious nutritional disorders, and even occasionally by familial peculiarities in which disease plays no part."

A complete classification and discussion of dental defects that are generally considered to be results of heredosyphilis seems a bit redundant. Before attempting to classify or to enumerate these dental anomalies, it should be recalled that Smith says, "I doubt that a diagnosis of congenital syphilis should be made on dental evidence alone. However, this is seldom necessary, for, with suspicion aroused by the teeth, other signs, symptoms or stigmata of the disease are usually discovered."

As a rule, there are few failures to recognize true hutchinsonian teeth, but there are many central incisors that can be classified as "near hutchinsonian." They may have sides that are parallel, the cutting edge no wider than the base, or the edge may be beveled, notched or normal. The next most frequent defect found is in the first permanent molars. These teeth appear normal at the gum, but at the baseline of the cusps, there is a definite shoulder formation and the cusps occupy a smaller area, or there is a conical narrowing from this shoulder, and the cusps are smaller than normal, friable, easily broken and prone to early decay. The grouping of these cusps have suggested the name "mulberry molar." Smith says that the cusps on these molars have no pathologic significance.

Poorly developed lower incisors are commonly associated with syphilis (widely separated or with eroded, pitted or grooved enamel), but they are seldom found in the absence of other syphilitic dental defects. In some children, there is a definite failure in development of the alveolar process of the lower jaw, which thus contributes a share in producing the malocclusion. Other children may show an elongation of the lower incisors, which might be an attempt on the part of Nature to overcome the malocclusion. Whether the numerous other dental dystrophies are signs or symptoms of congenital syphilis is without the sphere of the physician. It might not be amiss, however, to enumerate other signs that may correlate dental evidence.

Interstitial keratitis occurs in about 52 per cent of the cases of heredosyphilis that are brought to physicians' offices

and clinics for treatment. It is relatively easy to note the nebulae or whitish marks in the cornea or to observe that the patient has a photophobia and attempts to shield his eyes from the strong dental-lamp. Like the dental marks, it may be associated with the bulging forehead, saddle nose or scars radiating from the angles of the mouth and lips. There may be an anterior bowing of the tibiae or a markedly enlarged clavicle. These signs are usually present either singly or in combination. It is a relatively simple matter to look for eighth nerve deafness, using the watch test and later confirming the findings by testing for bone conduction.

It is a well-proven fact that when these signs are noted and treatment is instituted, many of the bad effects already present can be lessened; but what is more important, inauguration of treatment almost immediately renders the condition noninfectious and prevents further disabling or crippling effects.

It would be a real advance toward the conquest of syphilis if all dentists would look for syphilitic stigmata as did Sir Johnathan Hutchinson, who wrote, "I have repeatedly ventured to pledge myself to a diagnosis of hereditary syphilis founded solely on the state of the teeth, and subsequently found that the patient's history placed the correctness of the opinion beyond a doubt."

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DENTISTRY AT THE NEW YORK WORLD'S FAIR OF 1939

Not many people believe that "an apple a day keeps the doctor away," but the appalling number of people who do believe that a toothbrush and a tube of tooth paste or powder keeps the dentist away makes it imperative that the dental profession, for the sake of the public it serves and for its own sake, counteract the popular misconceptions prevalent regarding dental health and care. Realizing that the New York World's Fair of 1939 will afford an opportunity of reaching from three to five million people, who will visit the Medical and Public Health Building at the Fair, the Dental Society of the State of New York is taking advantage of this opportunity to present the most extensive dental education program ever undertaken.

The centrally located Medical and Public Health Building at the Fair, in keeping with the theme of "The World of Tomorrow," will dramatically portray scientific advances which deal with the promotion of human health, happiness

and efficiency. Dentistry must play a part in this story of man's fight against health hazards. Assuming the leadership to assure an exhibit which cannot fail to impress the visitor with the importance of frequent and proper dental care, the state society points out that all dentists will share in the benefits of such widespread education, and that all dentists should likewise share in making this exhibit possible.

Russell W. Tench, president of the Dental Society of the State of New York, in an appeal for support of this enterprise, said, "A fund of at least thirty thousand dollars is needed, and I appeal to every dentist, particularly those east of the Mississippi, to support this project, which will benefit the public, dentistry and each individual dentist. We are not selling stamps or seals, as we feel that it would be wiser to use the entire contribution for the purpose in hand; namely, to erect a striking exhibit telling the story of what dentistry means to public health and human happiness. All contributions will be welcome. None will be considered too small, nor none too large. We want every dentist represented."

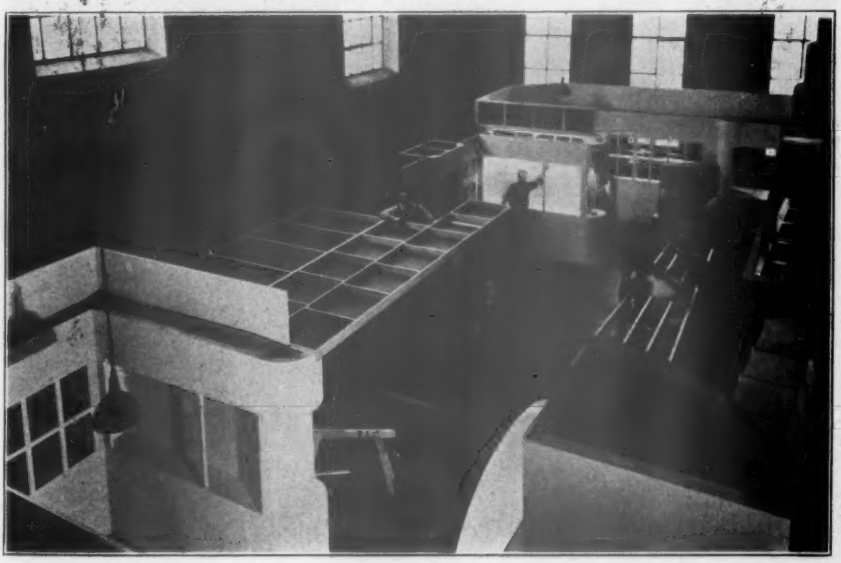
Contributions should be made payable to the Dental Society of the State of New York, World's Fair Fund, and should be mailed to the secretary of the society, Charles A. Wilkie, 1 Hanson Place, Brooklyn, N. Y.

DENTISTRY AT THE GOLDEN GATE EXPOSITION

Visitors at the Golden Gate Exposition to be held next year on Treasure Island, San Francisco Bay, will be forced to stop and look, if not listen, to dentistry.

The accompanying photograph, taken October 26, shows the A.D.A. exhibit well under construction. As work progresses, other photographs will be taken to record progress.

The Golden Gate Dental Exhibit, which



A.D.A. exhibit for Golden Gate Exposition in process of construction, October 26, 1938.

will occupy exceptionally fine quarters along the main center isle of the Exposition Building, is about 50 feet long by 23 feet deep. A series of eighteen hand colored translights depicting the history of dentistry illuminate one end. Eighteen translights on preventive dentistry occupy the opposite end. Sixteen translights showing the teeth of primitive people before and after exposure to the white man's diet are displayed at one end of the back wall. At the opposite end will be displayed a number of interesting x-ray films of dental conditions. Four electrically motivated displays showing the effect of teeth on personal appearance, the effect of teeth on health and efficiency, the manner in which dental caries attacks a tooth and the effects of calcareous deposits will add motion and life to the exhibit.

A model moden dental office contrasted with an 1860 office forms the *pièce de résistance*. Four floor cases containing interesting dental exhibits and a question box will occupy the space in the foreground.

ST. LOUIS CHILDREN VISIT YOUTH LANE

Five thousand children viewed five thousand posters in the 500-foot Youth Lane during the five-day St. Louis meeting. Five hundred school children under the direction of the St. Louis Dental Society were conducted each morning and each afternoon through the lane, where they had an opportunity to examine posters made by children

Children entering Youth Lane at St. Louis Session.

Children enjoying movie in Youth Lane.

St. Louis children visiting Youth Lane.

in thirty-one states, Washington, D. C., and Hawaii. The Lane was lined on one side with posters. Along the opposite wall were arranged exhibits that were especially interesting and educational to children. After studying the exhibits and the posters and admiring the beautiful prize loving cups and encyclopedias which were on display, the children were ushered into a motion picture theater, where they were shown a comedy and a dental health film. At the end of the performance, each child was given a souvenir "Answer Your Own Dental Question" chart. The children were transferred to and from the auditorium in large school busses. Youth Lane gave the Association an opportunity to perform an excellent bit of educational work for St. Louis children.

The St. Louis Dental Society and the St. Louis Board of Education were quick to grasp the opportunity. It is sincerely hoped that through Youth Lane, the motto "Dental Health for American Youth" will become an actuality for many St. Louis children.

Fifteen prize-winning posters in the National Dental Health Poster contest and fifteen loving cups and five sets of Encyclopedia Britannicas given as prizes.

DENTAL EDUCATIONAL MODELS—SERIES C

Light, large and serviceable, colored latex models are an adjunct to any dental health educational worker. Series C are reproductions of models originally made by R. H.

Johnson. They are for rent or sale by the Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Ill.

C-1: Sixteen-inch section of lower molar. Price $6; rental per week $1.

C-2: Fourteen-inch section of jaws. Price $6; rental per week $1.

C-5: Ten-inch heads showing normal occlusion and results of loss of lower first molar. Price $12; rental per week $1.

C-7: Ten-inch head showing dentition of 6-year-old child. Price $6; rental per week, $1.

C-6: Ten-inch heads showing normal profile (a), thumb-sucking (b) and results of thumb-sucking (c). Price $18; rental per week $1.50.

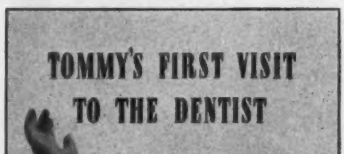
C-3: Masks showing closing of bite caused by loss of first permanent molars (b) and corrected case (a). Price $12; rental per week $1.

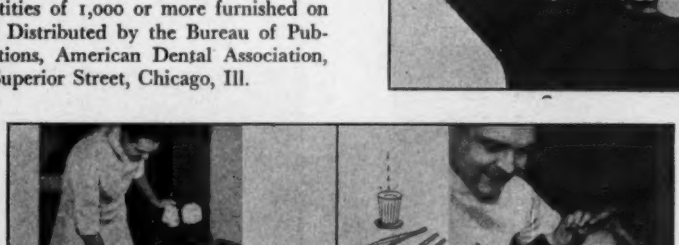
C-4: Face mask of edentulous patient before (a) and after (b) insertion of dentures. Price $12; rental per week $1.

TOMMY'S FIRST VISIT TO THE DENTIST

In a twelve page booklet, beautifully illustrated with photographs of Tommy, and designed for the preschool child, this little story of a real boy's visit to a real dentist has been retold, with pictures, to help other children understand just what to expect on their first visit to the dentist. We all know that much unnecessary anguish will be spared the child later if he learns early that trips to the dentist are interesting experiences and that the dentist is a friendly ally, always interested in helping him have strong, healthy teeth.

Single copies, 5 cents; 25 copies, $1. Prices on quantities of 1,000 or more furnished on request. Distributed by the Bureau of Public Relations, American Dental Association, 212 E. Superior Street, Chicago, Ill.





DENTAL ECONOMICS

DENTISTRY'S POSITION IN A CHANGING SOCIAL ORDER

By Lon W. Morrey, D.D.S., Chicago, Ill.

THE subject "Dentistry's Position in a Changing Social Order," or the dental manifestations of American social disease, cannot, of course, be adequately covered in a short time. All that can be done is to review some of the more important symptoms, past and present, and perhaps venture a prognosis.

Just as teeth are an integral part of the human system, dentistry is an important component of our social system. Just as the condition of the teeth affects personal health and, in turn, is affected by it, so too does dentistry affect the health of society and society's health most certainly affects it. These fundamental facts are all too frequently overlooked by diagnosticians. Specialists cannot cure the dental manifestations of our present social disorder without giving due consideration to the health of society; nor can they hope to cure society's ills without giving some consideration to its dental aspects. We are nourished by the same foods, bathed by the same blood and activated by the same stimuli. We can no more isolate dental disorders from our social body than we can segregate dental disease from the human body.

American dentistry, like American medicine, like American industry, commerce and art, has been developed to its present high position under a unique social system known as American democracy. For 150 years, the doctrine of liberty, free thought, free speech, free action has been inculcated in American minds. For a century and a half, we have built a society in which the city banker has been the son of the village blacksmith and the metropolitan manufacturer the son of the village mechanic. The history and progress of American dentistry is part and parcel of that development. Every dentist in the United States is a product of that doctrine. As a result, we are individualists; the dental profession is individualistic. As individuals, we worked a little harder, and strove a little longer in order that we might acquire something of an education and that we might be somewhat independent. Individually and collectively, our members worked even harder and strove even longer to raise our profession from its lowly beginning to its present level. Therefore, the professional man's antagonistic attitude toward government control of health service is perfectly natural. The majority of dentists are opposed to compulsory health insurance and state dentistry because these are contrary to the ideals and ideas with which they were reared. Many dentists are even opposed to an extension of public health dental service on the grounds that such service is undemocratic and contrary to the principles which, with the passing of seven generations, have become part of our very selves.

Organized dentistry is criticized by our more social minded citizens because

it has not whole-heartedly accepted and embraced the theories advanced during the past five years. Logically, it is no more possible for the members of the dental profession to change their ideas overnight in this respect than it is for them to change their religion. At the present time, a world war is hanging over the heads of Europe because one group of men is attempting a similar change. Ideals and opinions born and bred through seven generations cannot, nor should they, chameleon-like, be changed to reflect each change in society's shading.

We are told by some of the more ardent advocates of the new social order that the old democratic system on which this country was built is finished. Never again will be seen the prosperity of former years. It is as impossible to believe those pessimistic prophecies as it was to believe the 1928 optimists who maintained that America had at that time solved the problem of perpetual prosperity. The fact remains, however, that twelve million men are out of employment and almost one quarter of our population are on government relief. Many of these unfortunate people need medical and dental assistance. It is for these and for the medically indigent that the earnest social leaders and the earnest government health officials are primarily concerned and, despite arguments to the contrary, there are many social and government officials who are sincere, honest and earnest.

Immediately after the great fall of 1929, when society was still suffering from shock, when the pains and contusions were most acute, when the public pulse was mounting to 103 degrees, numerous panaceas were presented by both the earnest practitioners and the self-styled healers that always flock to the bedside of a sick patient. Dentistry, overnight, developed a horde of healers each one of which knew that his prescription would cure the dental phase of our disease. None of these prescriptions proved practical because they were, after all, local treatments to be administered to a patient suffering from general septicemia.

It is needless to remind you that much abuse and criticism were directed at dentistry's leaders by many both inside and outside the profession because they were unable to devise a practical plan that will economically and satisfactorily supply our citizens with adequate dental care and, incidentally, supply dentists with adequate dental patients.

Fortunately for the public and for dentistry, the officers and delegates of the American Dental Association have not been stampeded into writing a wrong prescription. As early as 1934, the American Dental Association House of Delegates passed the following resolution:

1. In all conferences that may lead to the formation of a plan relative to this subject, there must be participation by authorized dental representatives.
2. The plans should provide dental care for indigents and needy children.
3. The plans should give careful consideration to the needs of the people, the obligation to the taxpayer and the interests of the profession.
4. The plans should be flexible so as to be adaptable to local conditions.
5. There must be complete exclusion of proprietary or profit making agencies.
6. All features of dental service in any method of dental practice shall be under the control of the dental profession, as no other body or individual is educationally equipped to exercise such control.
7. All legally licensed dentists of a locality should be eligible to serve under such regulations as may be adopted.
8. Persons eligible to such service should be free to choose their dentist from the list of those who have agreed to furnish service under the adopted regulations.
9. Freedom of practitioners to accept or reject patients, and freedom of all persons who so prefer to obtain dental service other

than that provided by such plans, must be assured.

10. An adequate program should be provided for public education on the need of and the opportunities for dental care.

In February of 1935, the Board of Trustees passed the following resolution:

The Board of Trustees of the American Dental Association believes that the enactment of a program of compulsory health insurance administered by the Federal Government, the governments of the individual states or by any individual industry, community or similar body, would inevitably lead to the regimentation and lay control of practice, which would not be in the interest of the public. That a lowering of the standards of dental practice would result is indicated by the evidence from compulsory health insurance legislation in the European countries, where it has been in operation for some years and where it has not only failed to accomplish the measures of alleviation expected of it, but also has seriously impeded practitioners of the healing arts in the performance of their duties and has been a barrier to the further scientific development of the professions. The Board of Trustees commends the House of Delegates of the American Medical Association and approves the action pertaining to compulsory health insurance taken at its February 16, 1935 meeting.

In November 1935, the House of Delegates approved the following resolution:

WHEREAS, for the past few years there has been considerable agitation concerning changes in medical and dental practice; and

WHEREAS, out of this discussion has come no concrete expression of opinion as to how to best furnish health service to all the people that would be at once fair and equitable to all parties concerned; and

WHEREAS, the Board of Trustees of the American Dental Association has gone on record as opposing the socializing of the dental profession and all plans of compulsory health insurance; and

WHEREAS, the Committee on Economics of the American Dental Association believes the most effective opposition to such forms of practice would be a system under full control of the organized health professions, which will supply health service to all of the people; and

WHEREAS, it has been the custom of our people, when seeking health service, to pay for what they get and get what they pay for, we recognize the fact that health service must be provided for the indigent and those whose income is insufficient to pay customary fees for dental care; and

WHEREAS, to meet these conditions, health services for the low income groups should be supplied at fees which are within the limits of their ability to pay, and the care of the indigent must be, as it always has been, a charity problem of each community; therefore be it

Resolved, that the American Dental Association in the Annual Session assembled approve of further study and experimentation with plans to furnish such services as have been established in Washington, D. C., and St. Louis, Mo., as we believe that the outcome of such practical research might terminate in a satisfactory solution to the vexing problems of providing adequate dental service to the low income group.

In July 1936, the House of Delegates passed two resolutions pertaining to public health dentistry:

1. The Committee on Economics recommends that funds allocated to states for dental purposes under the provisions of the Federal Social Security Act be used for dental health education, dental research, training personnel and dental surveys.

2. The Committee on Economics recommends to the Board of Trustees that steps be taken to use the good offices of the American Dental Association in requesting the Federal Government to provide much needed dental care for enrollees in CCC Camps. It is suggested that Trustee E. G. Meisel might make the necessary contacts with the proper authorities to improve this service.

In February 1938, the Board of Trustees passed the following resolution:

The Economics Committee has studied the problem of dental disease of the American people and believes that the most practical and economical method of solving this

problem lies in preventive dental measures for children.

We recommend that the American Dental Association through its component societies attempt to further stimulate professionally supervised community activities for the prevention of children's dental disease.

Furthermore, we recommend that these preventive measures be financed through community funds augmented by local, state and federal funds, if necessary.

In October 1938, the House of Delegates of the American Dental Association unanimously passed the resolution printed in this issue.

These resolutions indicate, to me at least, the American Dental Association's attitude regarding the public health aspect of dentistry. I interpret them to mean that the American Dental Association is opposed to compulsory health insurance, but that it does favor an extension and a definite enlargement of public health dentistry in all its phases, and particularly preventive dentistry for children.

The Association believes, as expressed in the 1935 resolutions, that supplying dental care to the indigent is not only a dental problem: it is a community problem, which can best be solved locally and should be financed from public funds. The American Dental Association has opposed compulsory health insurance, first, because it is not the most practical nor economical solution of America's dental problem, and, secondly, because it wholesomely fears the bureaucratic control that will surround the practice of dentistry should it be put in effect.

It believes that, for the best interest of the public's health, the public's purse, and the profession's future, America's dental problem should be approached along the broad lines of prevention.

It is realized, of course, that this type of program will not meet the immediate dental needs of a large part of our adult population. Furthermore, it is realized that a preventive program does not meet the desires or demands of many large groups of people. It was for that reason that the resolution was passed in 1935 favoring the establishment of local experimental plans to provide dental care to the low income class. During the past three years, a number of such plans have been developed in different parts of the country. Roughly, they can be classified under four headings: medical-dental service bureaus, such as those in Washington, D. C., St. Louis, Mo., and Detroit, Mich.; emergency relief programs, such as those in Chicago and New York City and many other communities; plans financed by government loans, such as have recently been put in operation in California, and, lastly, preventive dental programs for children, which are being rapidly developed under state dental society direction in thirty-three state health departments.

Several other states are contemplating the establishment of dental divisions in their departments of health, and it is hoped that, in the near future, every state health department will include a dental division in its organization.

The few medicodental service projects that have been established operate somewhat along the lines of the Washington, D. C., plan, which is as follows:

B. *Medical-Dental Service Bureau*

1. Controlled by a board of directors chosen from the local medical and dental societies, the amount of representation depending on the size of the society.
2. Purpose of the bureau is to arrange for systematic installment payments of medical, dental and hospital bills by creating a planned budget within the patient's financial scope.
3. Method of operation.
   a. The fee to be charged for the services is solely a matter between the dentist and the patient.
   b. The use of the bureau is optional with the dentist and the arrangements for payment are made before the work is done.

c. If both parties are willing, and agreement with the bureau is signed, payments are made to the bureau.
   1. Ordinarily, the bureau remits monthly to the dentist.
   2. The bureau deducts 10 per cent of each payment for its expenses.

4. Financial condition.
   a. The bureau began operation on a loan of $1,200 from the medical society and $600 from the dental society.
   b. The business actually transacted for the first year exceeded $175,000.
      1. $88,565.32 was actually disbursed to physicians, dentists and hospitals. This constitutes over 45 per cent of the total value, although the agreements averaged eight months in duration.
      2. The end of the first year showed the bureau highly solvent with a net realizable profit of $5,635.
5. Publicity is gained through the cooperation of employers in permitting inserts to be placed in employees' pay envelopes apprising them of the essential benefits of the plan. Talks to civic and industrial groups also spread the necessary information.
6. Proposed benefits of the bureau.
   a. The professional man is relieved of unpleasant and time-consuming economic relationships with the patient.
   b. The patient dealing with a business organization and knowing he has signed a contract will be more apt to pay regularly.
   c. The doctor is more apt to keep his clientele intact because the patient will be less apt to go to other physicians or dentists if not in default.
   d. No interest is charged, hence the patient has reason to understand he is being rendered a service and not being exploited.

In theory, these plans are excellent. In practice, they have not been so successful; first, because of public apathy toward dentistry and, secondly, because of the dentist's apathy toward the bureau's facilities. This substantiates the previous statement that dentists are, as a rule, individualists and prefer to handle their own problems in their own way.

The dental relief programs now in operation vary according to locality and local interest. Their services are limited by the amount of public funds allocated for that purpose, which, in turn, is regulated, to a certain extent at least, by the degree of interest which the local dental societies can engender in the appropriating bodies. Records in the Central Office indicate that, at the present time, there are thirty WPA dental projects in operation.

As can be expected, considerable criticism is directed from time to time at these projects because of administration defects. Inadequate supervision permits the unscrupulous to take advantage of the services offered and it also permits unscrupulous dentists to "ride" public pay rolls. On the whole, however, they have partially supplied a much needed want, and the defects are those which are common to all programs publicly financed and administered—defects which, in one form or another, always have been, and always will be, present until greed, corruption and chicanery are bred from the human race.

Last fall, the Weber County, Utah, farm bureau inaugurated a plan to provide dental care to the farmers of that county. The Weber District Health Association agrees to provide dental care for its members as follows: Families that join pay $35 for a life membership, plus an annual fee of $20 for a family of five persons or less, and $2 a year for each additional member. For these fees, members receive, at no additional cost, prophylaxis, x-ray films, examinations, extractions, amalgam and synthetic porcelain fillings and pyorrhea treatments. Inlays and gold fillings are furnished on payment of the additional cost of the gold used. Dentures are furnished at cost. In spite of the objections of the Utah State Dental Association, and in violation of the state dental law, the Weber District Health

Association is in operation, but, like all other unsound plans, it is, from latest reports, floundering rather than functioning.

In May 1938, there was formed, in California, a corporation known as the Agricultural Workers Health and Medical Association. The purpose of this association is to provide medical care and emergency dental care and treatment to indigent agricultural workers. Funds to provide this care are obtained in the form of grants or loans from the Farm Security Association. The money is loaned to the worker for medical or dental care. He is supposed to repay the loan if and when he can. At the present time, the California State and the Southern California Dental Societies are submitting a plan by which the component dental societies may be guided in their transactions with the workers' association. Briefly, the plan provides for the same full schedule as that used for state relief cases. The indigent farm worker needing medical or dental attention, after being cleared by the social worker, chooses his physician or dentist from those listed as being willing to supply the services for the fees agreed on. The physician or dentist is reimbursed by the agricultural health association.

The latest plan and one most significant from several angles is now being put in operation in San Francisco. This is a compulsory health insurance plan for the municipal employes of that city, who, it is estimated, constitute about 10 per cent of San Francisco's population. As originally proposed, the plan provided medical care to municipal employes and their families for a monthly premium of $2.50. Certain costly medical services were excluded. Dental care and dental services were prohibited. The San Francisco dentists objected to this ruling as, under the original wording, member patients suffering from fractured jaws and osteomyelitis of the jaws, Vincent's infection and a number of other diseases of the oral cavity would not be permitted to obtain treatment from a dentist as only physicians were permitted to render services. The San Francisco Dental Society insisted that this was discriminating against the dentists, but not until they brought suit in the Supreme Court did the San Francisco Health Service Board change the wording of the plan so that dentists could be admitted to the consultant and professional staffs, subject to the same rules and regulations as are physicians.

It is neither possible nor necessary to recount in detail other plans that have been put in operation for the purpose of supplying dental care to the indigent and low-income group. Those that have been mentioned give a general idea of the changing public attitude toward health care, including dental services.

Dr. Parran, in October 1938, emphasized this changing attitude by the following statement:

> I believe that today we see the first faint stirrings of a world movement for health. The Renaissance was an upswing from the dark ages toward art. The French Revolution was the beginning of a fight for political freedom. Today, people are beginning a fight for life and for freedom from disease.

Dr. Parran's statement is the statement of an energetic and optimistic health officer. Knowing that an abundance of health knowledge is available and so little of it applied by those who need it most, I personally cannot share the Surgeon General's faith. However, the public's attitude toward public health is slowly undergoing a change—a change which, if properly directed, will mean better health for the nation and greater opportunities for dentistry.

Social and political leaders are fully aware that these changes are taking place and both are attempting to direct those changes to their own advantage. The objects of the two groups are by no

means identical. Conflict between the two forces is inevitable, and medicine and dentistry are bound to be buffeted by the storm that ensues.

Three years ago, in August 1935, President Roosevelt appointed an interdepartmental committee to coordinate health and welfare activities. Last March, after two and one-half years of study, this committee made its report and recommendations to the President. At the President's suggestion, Miss Roche, chairman of the committee, called a meeting of representatives of the public and of the medical and other professions to discuss these recommendations. At this meeting, held last July, at which more than 300 people were present, the three day conference was packed with emotional appeal from labor, farm and social leaders and with cold statistical data from government officials regarding the health needs of the people.

The meeting was so recent and so well publicized and reported that it is not necessary to restate many of its details. Two very significant facts, however, should be mentioned here: First, with no exception, leaders of labor, agriculture and welfare demanded more and better health care for their constituents at public expense. The method of administration, the method of payment and the extent of the services demanded varied according to the ideas of the individual speakers and those whom they represented. All were in accord on the one fundamental fact that government subsidized health care must be given the American low income groups. Secondly, a fact which is most important to dentists, dentistry was merely mentioned by lay leaders or by the government officials.

Labor, farmer and other worker groups apparently are, at the present time, chiefly concerned with providing themselves with security against the catastrophic diseases. Dental disease, in their minds, is one or more steps removed from that category. Members of the government's technical committee are very much better informed regarding the extent and seriousness of dental disease, but at present they are skeptical of ever being able to include complete dental care in any health insurance program, because of the tremendous cost involved.

At the present time, if one can judge correctly from their statements, Dr. Parran, Surgeon General of the United States Public Health Service; Miss Lenroot, chief of the Children's Bureau; Dr. Martha Elliot, of the Children's Bureau, and other members of the federal government's health staff, like the officers of the American Dental Association, believe that the proper approach to the control and elimination of dental disease lies through prevention. They definitely favor an extension of children's dental programs by states and municipalities. Miss Lenroot's paper, which she delivered at the American Dental Association meeting in St. Louis, emphasizes the need for an extension of dental services in state maternal and child welfare activities. Dr. Camalier, President of the American Dental Association, speaking before the National Health Conference last July, recommended that the broad approach to dental health be made through preventive dentistry. He advocated that children's dental programs be greatly extended and that government funds be provided for adequate research in the field of dental caries. The last is a tremendously important recommendation as dental research is one phase of dentistry that has been unpardonably neglected. Thoreau remarked years ago that "there are a hundred men hacking at the branches of evil, to one striking at the root." We have hacked too long at the branches, and one of the first steps which organized dentistry should take in response to the public's awakening interest in health should be to inaugurate a research program that will definitely determine the cause of dental decay.

Dr. Camalier further stated that pro-

viding dental care for indigent adults was a government responsibility and that it should be financed from government funds. Such care should be viewed as a public health and humanitarian problem and therefore should consist primarily of the removal of infection and the elimination of pain. It must be recorded that Dr. Camalier spoke not as an official representative of the American Dental Association, but as an individual dentist who is vitally interested in the problem.

So far, this paper has been a delineation of facts presented for the purpose of acquainting you with the trends in health services as they influence dentistry. In conclusion, I wish to inject one or two thoughts of my own. It seems to me that, in the main, the policies of the American Dental Association are not, nor have they been, very far afield from those expressed in the recommendations of the government's technical committee, with the exception of that part of the recommendation dealing with health insurance.

The American Dental Association has for years advocated an extension of public health dental programs. It has favored an enlargement of the dental preventive work by the United States Public Health Service, the Children's Bureau of the Department of Labor and state and municipal health departments. It has long since agreed that providing dental care to the indigents was a community problem and should be financed from public funds. The American Dental Association, through its House of Delegates, opposes compulsory health insurance because it believes health insurance to be an illogical, unsatisfactory and uneconomical solution to the problem. Furthermore, government control of dental health care will inevitably place objectionable restrictions, checks and restraints on the individual dentist, and certain harmful inhibitions and limitations on the dental profession as a whole.

In the meantime, let us not allow ourselves to be stampeded by fear. Discount the statements of those who would have you believe that dentistry is doomed. Dentistry and dentists will be inflicted on society, by society, for generations to come. The fact that people wish for health does not mean that they will work for health, and until they work as well as wish, human teeth will need attention.

Alarmists would have us believe that we are approaching a crisis in dentistry. What of it? We have met and conquered crises in the past and are the stronger and better for it. Private enemy No. 1. of human life is fear. Fear of tomorrow. Fear of the future. Fear of the imagined dangers that lie beyond the bend of the road. That is why the laborer and the farmer demand public subsidized health care—they fear their ability to take care of themselves. That is why politicians write health planks in platforms—they fear that if they do not, they will lose votes. That is why we as dentists object to government control of health services. We fear that initiative will be stifled and that the profession will retrogress. In my estimation, none of these fears will materialize to any great degree. Compulsory healthy insurance will not raise national health standards, and it is problematical whether it will materially assist the individual to solve his health problems. National health standards will never be raised and individual health problems will never be solved until individuals learn the art of right living. Health planks in political platforms give politicians but transient advantage over their opponents. Health planks can be nailed into any platform, and each year they will grow longer and broader, until they cease to attract votes. The profession of dentistry will progress in the future just as it has in the past through the initiative and pride of achievement which is a dominant professional characteristic. True, new obstacles will be placed in our

path, new problems will have to be solved—problems of social and public relationship with which we are not now familiar—but I am confident that they will be met and mastered. There will always be a place and a demand for the competent dentist—for he is the one whom the individual must turn to for dental care. Dental societies must assume greater leadership in preventive dental programs. They must convince the social leaders, the statesmen and the politicians that therein lies the solution of our particular branch of humanity's health problem.

There *is* a change taking place in the practice of dentistry—and a greater change will I hope take place in the future. We as a profession are just beginning to learn our proper place in the field of health. We are just beginning to practice preventive dentistry; yet it is said that the average dentist spends but 2 per cent of his time on child patients, and 90 per cent of our children need dental care. That is not economical. Parents neglect defects in their children's teeth—defects that it would cost a paltry sum to correct. A few years later, these same children must spend large sums for artificial replacements. Certainly this is not economical.

There are two ways in which our dental problem can be attacked. One through the costly archaic and never satisfactory method of replacements for adults; the other through the less expensive, modern and more satisfactory method of preventive care for children. I sincerely hope that our leaders in the fields of health and social science will choose the latter course. Should they blindly choose the former, we will simply be following the same stupid procedure that society has followed for centuries in attempting to solve the problems of crime and insanity. All society has succeeded in doing so far is to raise enormous buildings and enormous taxes in an unsuccessful effort to correct a condition which, in most instances, could have been prevented at very little expense.

Should society succeed in its demands for a compulsory health program, it should be reminded that health insurance, like politics, makes strange bedfellows. Under the same coverlets lie the earnest social leader, zealously intent on aiding humanity; the practical social worker who seeks the security of a job; the honest, efficient, well-trained health officer who knows the country's health needs and wishes to improve them; the petty health officer, who, to hold his job, must cater to his political bosses and staff his department with political appointees, and the politician whose first interest is votes. At the foot of the bed, half in and half out of the coverlets, lie the medical and dental professions, kicked about each night by the nightmarish spasms of their bedfellows, and, if society is successful in making this bed in which to lie, medicine and dentistry will continue to be kicked about until, with great effort, they wedge themselves into the very middle of the soft, warm, feathered nest.

212 East Superior Street.

CURRENT LITERATURE

What Report Should a Physician Expect from a Dentist?

By G. Morgan

Dental infection is one link in the chain of etiologic factors in certain diseases. It is not necessary that the teeth or the structures adjacent to them show demonstrable symptoms of infection to be etiologic factors in certain diseases. The author cautions the dentist to use recognized methods in making his diagnosis, and stresses the importance of the x-rays. He shows a dental chart which includes the things which he thinks should be included in all dental reports. The items in this report are arranged in such a way as to be easily read and understood by the physician. A complete report on the oral cavity, as well as on the teeth and adjacent structures, is included. It is suggested that the dentist make the report personally and not have the patient deliver it.—*Canadian M. A. J.*, 39:465, November 1938.

L. H. Garrison.

Minimal Vitamin C Requirements of Artificially Fed Infants

By B. M. Hamil, L. Reynolds, M. W. Poole and I. G. Macy

In the authors' efforts to determine the mineral vitamin C requirements, they noted, in regard to the teeth, that vitamin C had no effect on eruption of teeth. However, they showed by their data that conditions predisposing the infant to scurvy resulted in retardation of growth and eruption of teeth.—*Am. J. Dis. Child.*, 56:561, September 1938.

B. J. Frey.

Roentgenographic Diagnosis of Vital Pulp Infection as Confirmed by Bacteriologic Examination

By M. J. Fuendeling and T. L. Cartney

Infectious processes of the dental pulp tissue can be diagnosed from roentgenograms by recognizing changes in the continuity of pericemental membranes and variations in the density and structure of the alveolar bone. Bacteriologic study was made of pulp tissues of the extracted teeth in several cases which were the cause of the oral condition and also affected the general systemic condition.—*Am. J. Roentgenol.*, 40:386, September 1938.

B. J. Frey.

Alcohol Injections in Inoperable Malignant Growths of the Jaws and Tongue

By W. Harris

For the severe pain accompanying hopeless cases of carcinoma of the tongue, maxilla and antrum, alcohol was injected into the gasserian ganglion, with complete relief. The anesthesia obtained was for the period of expectation of life. Carcinoma of the floor of the mouth may be relieved by injecting the third trigeminal division at the foramen ovale.—*British M. J.*, 2:831, October 22, 1938.

Martin Deakins.

Beobachtungen Ueber die Einwirkung der Gingivitis auf den Knocken (Observations on the Influence of Gingivitis on the Bones.)

By Adrion

It can be shown that inflammation of the gums can lead directly or indirectly to bone destruction. The possible cause of the inflammation, which may be local or general, is not considered. Gingivitis therapy is peridental prophylaxis. It is important to bring sufficient therapeutic attention to simple gingivitis.—*Deutsche Zahnheilk. Wchnschr.*, 41: 676, 1938.

Martin Deakins.

Lesions Cutanies par Applications de Solutions de Novocaine-Suprarenine (Cutaneous Lesions After Use of Procaine-Epinephrine Solutions)

By W. Foelsch

The author describes a series of cutaneous lesions after the use of procaine-epinephrine

solutions. In seventeen cases, this solution was positively identified as the causative agent of the lesions. The procaine alone was considered as hardly able to cause the trouble. The lesion in the mouth resembles medicinal exanthema, the clinical aspect being variable and the propagation limited to the environs of the injection. In four cases, the exanthema covered the entire body.—*L'Informat. Dent.*, 20:761, 1938.

MARTIN DEAKINS.

Congenital Syphilis in Bones and Teeth

By R. MCLAUGHLIN

AN article dealing with Hutchinson's incisors found in congenital syphilis discusses the well-known symptoms. Usually, the upper permanent incisors are affected. However, the lower incisors may show similar characteristics. X-ray study of the permanent teeth previous to eruption frequently reveals notching, together with a greater cervial than incisal diameter. An increase in labiolingual distance and the presence of pegged lateral incisors and pitted dentin aid in diagnosis. Mulberry molars are seen less frequently, since decay usually destroys such teeth soon after eruption. The tubercle of Carabelli, an accessory cusp on the lingual aspect of the upper first molar, is taken by some to be suggestive, but not diagnostic, of congenital syphilis. Frequent findings are increased space between the lower incisors, aplasia and dystrophy of unclassified types, malocclusion and delayed dentition. In about 30 per cent of the cases of heredosyphilis, teeth are perfectly normal.—*Arch. Pediat.*, 55:621, 1938.

FRANK ALLEN.

Subthyroidism with Defective Dental Development

By C. KERLEY

A 15 year old girl was retarded in growth to that of a 12-year-old child. Outstanding in the general delayed development was the late shedding of the deciduous teeth. All but one of these teeth were present and badly worn. Roentgenograms showed the deciduous incisor roots to be resorbed and the permanent incisors fully calcified and in proper position for eruption. All permanent teeth were in normal position under the unexfoliated deciduous dentition. On desiccated thyroid, normality returned and appearance and social contacts were aided. Ten months after the beginning of treatment, roentgenograms revealed fully formed permanent teeth, with the exception of the third molars.—*Arch. Pediat.*, 55:548, 1938.

FRANK ALLEN.

Efficiency of Several Germicides and Antiseptics on the Oral Mucosa

By E. MEYERS and L. ARNOLD

THE authors determined the efficiency of fifteen germicides and antiseptics when applied to the oral mucous membrane. Included in this number were such commonly used antiseptics as sodium perborate, hydrogen peroxide, S.T. 37, mercurochrome, merthiolate and metaphen. The average reduction in the bacterial count in five minutes and the duration time of the antiseptic action were the properties considered. It was found that metaphen 1:200 was the most efficient agent both in its germicidal action and in the duration of its antiseptic action, which was two hours. The average reduction of colonies in five minutes was 100 per cent.—*Am. J. Digest. Dis.*, 5:418, 1938.

J. VOLKER.

Eine Neue Behandlungsmethode der Trigeminusneuralgie (A New Treatment for Trigeminal Neuralgia)

By O. RIED

INJECTION of a solution of irradiated sodium sulphate and sodium chloride about the affected divisions of the trigeminal nerve gave relief which lasted in some cases for several days. Many cases were permanently relieved after three or four injections. Others required twenty or more.—*Acta Med. Scandinav.*, 46:105, 1938.

MARTIN DEAKINS.

Apicoectomy: General Considerations and Subsequent Root-Canal Therapy

By R. TAYLOR

THE author presents a time saving technic for the treatment of infected upper anterior teeth which is just the reverse of the usual method. After the acute symptoms have subsided, a rubber dam is applied to the infected and adjacent teeth. With the upper border of the dam turned down and sponges placed so as to isolate the field, an apicoectomy is

performed, after which the cavity is packed with iodoform gauze. The root canal is then cleaned and filled aseptically, the iodoform gauze removed and the periosteum sutured. This method has the advantages of requiring only one to one and one-half hours' time and the canal can be thoroughly dried before filling. Healing usually continues without drainage.—*U. S. Naval Med. Bull.*, 36:511, October 1938.

S. B. Finn.

Salivary Gland Tumors

By N. Swinton and S. Warren

Salivary gland tumors are not of rare occurrence. In a period of ten years, a total of eighty-one salivary tumors were operated on. Of this number, seventy-two were benign and nine malignant. Of the seventy-two benign tumors, fifty-one were mixed tumors with a most variable and complicated histology. The incidence of recurrence in the mixed tumors following operation was 4.3 per cent. Eight of the nine patients with malignant tumors were women. The average age of patients with malignant tumors was 59.8 years; and of those with benign tumors, 44 years. From this series of cases, the incidence is definitely in favor of embryologic misplacement of cells as the mode of origin of most salivary gland neoplasms.—*Surg. Gynec. & Obst.*, 67:425, October 1938.

J. Volker.

Relation of Drug Therapy to Neutropenic States

By Roy R. Kracke

The incrimination of aminopyrine in the production of agranulocytosis seems well established. 1. Geographic studies show that the incidence of the disease closely parallels the use of the drug. The disease has practically disappeared in Denmark since the importation of aminopyrine has been prohibited. 2. The incidence is higher for groups of the population that are the most habitual users of the drug. 3. Collection of records shows that in a large majority of patients with agranulocytosis, the disease has followed the administration of the drug. 4. Administration of aminopyrine to an occasional patient who has recovered subsequently reproduced the disease.

Statistics indicate that 80 per cent of drug-produced agranulocytosis is caused by the administration of aminopyrine or one of its compounds. Consequently, caution should be exercised in the use of any of the long list of preparations containing this drug.

The author points out also that 20 per cent of the cases of agranulocytosis are caused by administration of dinitrophenol (used mainly in the treatment of obesity), arsphenamine, novocaine and perhaps one or two other drugs. He concludes that the disease is now decreasing in the United States, but warns that indiscriminate sale of sulfanilamide will probably increase the number of cases.

M. K. Hine.

Possible Lead Poisoning from Tooth Paste Tubes

If the tube in which tooth paste is enclosed is made of lead, there may be a small amount of lead dissolved in the paste. (Danckwortt, P. W., and Siebler, G.: Zur Toxikologie des Bleis und seiner Verbindungen: III. Bleihaltige Zahnpasten, *Arch. d. Pharm.*, 265:424-426, May 1927). If the tube is tin lined, or otherwise adequately protected, there is no lead absorption by the paste. One cannot be sure that discoloration of tooth paste is due to a contamination of lead unless this is shown by chemical analysis. The amounts of lead found in tooth pastes by Danckwortt and Siebler were not large, and when one thinks what small quantities of tooth paste are used it appears most unlikely that a toxic amount could be obtained from this source. Most tooth pastes are now put up in tin-lined tubes.—Queries and Minor Notes, *J.A.M.A.*, 111:1399, October 8, 1938.

M. K. Hine.

Change of Water Supply Reduces Mottled Enamel Incidence

By H. T. Dean, F. S. McKay and E. Elvove

In Bauxite, Arkansas, in 1928, when the community was deriving its water supply from deep wells, the mouths of 458 school children revealed 202 cases of mottled enamel, or 44 per cent. The fluorine content was 13.7 parts per million at that time. The community changed its water supply to filtered river water which contained no fluorine the same year, and in 1938, examination of forty-five children from 6 to 10 years old

who had received this water revealed only two cases, of very mild abnormalities of the enamel.—*Pub. Health Rep.,* 53:1736, September, 1938.

J. VOLKER.

Some Observations on the Examination of Men Exposed to a Lead Hazard at Mt. Isa

By L. MCLEAN

A TOTAL of 115 men employed at the mine were examined for lead poisoning symptoms. Burton's line was observed in only five cases, and in two of these it was very slight. The author noted that the standard of mouth hygiene in general was good and offers this observation as a possible explanation of the infrequency of the sign.—*M. J. Australia,* 2:367, September 1938.

J. VOLKER.

Treatment of Skin Cancer

By E. C. FOX

THE comparative benefits of treating primary squamous cell carcinoma of the skin and lip by surgery, electrotherapeutic means and irradiation are discussed. The number of cures by controlled erythema irradiation equal those of other methods and the cosmetic results are better. The importance of biopsy prior to treatment is stressed. The reaction which develops is not severe and reaches its height about the tenth day after the last exposure, disappearing by the end of the third or fourth week. Small radium needles are preferred for extensive deeply infiltrated and inaccessible lesions of the skin or lip.—*South. M. J.,* 31:1139, 1938.

VIRGIL D. CHEYNE.

Effect of Hyperthyroidism on Growth and Chemical Composition of Bone

By E. E. SMITH and F. C. MCLEAN

ANY work on bone should be of interest to those concerned with tooth structure. The anabolic and catabolic effect of thyroid feeding on bone is discussed. Most literature cited reports excess excretion in such cases. Young and adult rats were used in this work and severe hyperthyroidism revealed no evidence of failure of calcification in the growing rats or of decalcification of the bones of older ones. To maintain this condition, however, it is advised that the diet contain adequate calcium. Apparently, the absolute and relative amounts of water in the bones of treated rats increased, but there was no significant difference in the chemical composition. Premature closure of epiphyseal junctions of long bones did take place.—*Endocrinology,* 23:546, 1938.

VIRGIL D. CHEYNE.

L'Idiosyncrasie a la Novocaine (Idiosyncrasy to Novocaine)

By H. HENSEN.

A BRIEF review of the literature is presented together with a single case report. The patient, a healthy woman, had a violent reaction to novocaine, characterized by a dermatitis, intermittent attacks of painful paralysis and nervous collapse. The psychic factor is considered. Prophylactic measures, skilfully directed psychotherapy and fresh solutions of novocaine are advised.—*L'Informat. Dent.,* 20:1019, October 1938.

J. VOLKER.

Allergy to Mercury in Amalgam Fillings

To the Editor: A woman has a skin eruption diagnosed by one skin specialist as "infectious dermatitis" and by another as an allergy against mercury. A skin reaction to mercury can be experimentally produced. She has a great many silver amalgam fillings in her mouth. Has an allergic reaction to the mercury in fillings been reported?

Answer. Allergy to mercury is one of the most common causes of allergic dermatitis. The usual contact is one directly to the skin either by the handling of mercury compounds or by the use of medicaments containing mercury, such as antiseptics and mercury ointments. That sufficient mercury may be absorbed from amalgam fillings to cause mercury poisoning is evidenced by the numerous reports in the literature, among which are the following:

Stock, A.: *Arch. f. Gewerbepath. u. Gewerbehyg.,* 7:388, 1936.

Stefensen, K.: *Ugesk. f. læger.,* 96:855, Aug. 2, 1936.

Herrenknecht, W., and Scheidt, C.: *Fortschr. d. Zahnheilk.,* 6:664, August 1930.

Meyer, E.: *Med. Welt,* 4:703, May 17, 1930.

Fluchel, A.: *Aertzl. Rundschau,* 38:309, October 25, 1928.

It stands to reason that if sufficient mercury can be absorbed from amalgam fillings to produce mercury poisoning, the amount would be sufficient to produce inflammatory reactions of the skin if the patient happened to be sensitive to mercury.

A case is reported of dermatitis caused by the mercury in dental amalgam (Blumenthal, Franz, and Jaffe, Kate: *Deutsche med. Wchnschr.*, 55:1720, October 11, 1929).

There are undoubtedly other cases in the literature and many more unreported. Attention must be called to the fact that other metals also are used in dental fillings, and the possibility of dermatitis due to other metals must be kept in mind.—Queries and Minor Notes, *J.A.M.A.*, 111:646, August 13, 1938.

M. K. Hine.

Acute Ulcerative Stomatitis

By E. W. Fish

The signs and symptoms of Vincent's infection of the gums are reviewed and the limitation of the inflammation to the gingival margins is emphasized. The pathologic process is differentiated from that of pyorrhea by the absence of deep tissue destruction and the occurrence of rapid sloughing of infected tissue. Treatment by packing the gum margins with a paste of zinc oxide and oil of cloves is recommended. Extraction should be delayed until packing has made the gum margin healthy. Cautery of the periodontal ulcers is advised.—*Lancet*, 235:558, 1938.

B. G. Bibby.

Dental Survey of School and Preschool Children of New South Wales

By R. M. Kirkpatrick

Nine hundred and twenty school and preschool children in New South Wales were examined for oral diseases and defects. The diseases were related to oral hygiene, crowding of the teeth in the arches, intake of sweets, the incidence of rickets and the incidence of hypoplasia. Facts disclosed by the survey were that 97.5 per cent of the children 5 years of age and over suffered from dental caries; only 7.28 per cent of all the children were free of dental caries; on the average, there were about thirteen carious surfaces to each child; 54 per cent of the children had stains on the teeth; 8 per cent of the children showed crowding of the teeth; 12 per cent showed hypoplasia of the enamel; the average degree of cleanliness was between fair and good; 61 per cent of the children suffered from gingivitis, the average severity being slight; about 2 per cent of the children had hyperplasia of the gums, and hypoplasia of teeth characteristic of fluoride mottling was observed.

The following conclusions were based on statistical analysis of the related observations.

1. The greater the lack of oral hygiene, the greater the incidence of dental caries.

2. Freedom from dental caries is associated with a low intake of sweets and rampant caries with a high consumption of sweets. There are more carious surfaces when the consumption of sweets is high than when the consumption is low.

3. Teeth which commence calcification during the period of rickets in rachitic children have not proved different from the corresponding teeth of nonrachitic children in their susceptibility to dental caries.

4. The incidence of caries in the teeth of children who show hypoplastic defects in at least one of the teeth in each case is no different from that in normal teeth.

5. The health of the gingivae is related to oral hygiene; the better the oral hygiene, the better the gingival condition.

6. Gingivitis is associated with crowding of the teeth in the arch.

7. Gingivitis and dental caries are in these children closely related.—*D. J. Australia*, 10: 418, 1938.

B. G. Bibby.

Study of Dental Caries in School Children by Sex

By Henry Klein and C. E. Palmer.

The data presented in the analysis are based on dental examination of 2,232 boys and 2,184 girls attending elementary schools in Maryland. The higher caries experience of girls as compared with boys of the same chronologic age is explained quantitatively by the finding that girls, because their teeth erupt earlier than those of boys, are exposed longer (have a greater posteruptive tooth age) to the risk of attack by caries than are boys. They conclude that girls show no greater susceptibility to dental caries, therefore, than do boys.—*Pub. Health Rep.*, 53: 1685, 1938.

Joseph Volker.

DEATHS

Allen, William T., Boston, Mass.; School of Dentistry, University of Pennsylvania, 1885; died July 5.

Brenneman, John Forrest, Columbia City, Ind.; Chicago College of Dental Surgery, 1895; died October 12; aged 65.

Cooper, Morris Lane, Knoxville, Tenn.; School of Dentistry, University of Pennsylvania, 1918; died recently; aged 43.

Crutcher, Robert D., Sr., Lewisburg, Tenn.; University of Tennessee, College of Dentistry, 1889; died October 3.

Dempsey, Thomas F., Quincy, Mass.; Harvard University Dental School, 1916; died August 11.

Donovan, John E., Adams, Mass.; New York Dental School, 1897; died August 31.

Fitzgibbon, Frank J., Holyoke, Mass.; Temple University School of Dentistry, 1901; died August 10.

Foss, W. F., Hatton, N. D.; Northwestern University Dental School, 1914; died in July; aged 48.

Hallock, E. C., Manitowoc, Wis.; Chicago College of Dental Surgery, 1900; died October 11.

Hoermann, E. J., Watertown, Wis.; Marquette University Dental School, 1904; died May 11.

Jones, John M., Shelby, Iowa; State University of Iowa College of Dentistry, 1897; died July 20; aged 67.

Keith, H. L., Wilmington, N. C.; Atlanta-Southern Dental College, 1909; died July 29.

Keyes, Frederick A., Boston, Mass.; Harvard University Dental School, 1908; died July 26.

Koll, A. W., Gillett, Wis.; Marquette University Dental School, 1911; died October 5.

Leachman, Bartlett Ernest, Benton Harbor, Mich.; University of Indiana School of Dentistry, 1919; died July 23; aged 48.

Lingren, Wilmer Francis, Seattle, Wash.; North Pacific College of Oregon, 1930; died recently; aged 31.

Long, C. Smith, Portland, Ore.; North Pacific College of Oregon, 1908; died May 31; aged 56.

McGaughy, Frank C., Galion, Ohio; College of Dentistry of Ohio Medical University, 1897; died May 18.

McKenzie, E. W., Matador, Texas; Atlanta Dental College, 1907; died September 8.

McNutt, Robert S., Muscatine, Iowa; State University of Iowa College of Dentistry, 1878; died June 25; aged 74.

Magruder, R. B. L., Brooklyn, N. Y.; New York University College of Dentistry, 1896; died July 3.

Miller, Samuel S., Toledo, Ill.; Chicago College of Dental Surgery, 1905; died February 12; aged 67.

Morlan, James L., St. Petersburg, Fla.; Northwestern University Dental School, 1911; died in May; aged 62.

Mueller, G. B., Tripp, S. D.; State University of Iowa, College of Dentistry, 1921; died recently.

Nelson, N. B., Swanville, Minn.; University of Minnesota, College of Dentistry, 1912; died August 15; aged 52.

Offill, Robert H., Chicago, Ill.; Marion Sims Beaumont School of Dentistry, 1903; died May 2; aged 60.

O'Keefe, John J., Fargo, N. D.; Northwestern University Dental School, 1924; died recently; aged 37.

Oppegard, Henry A., Winona, Minn.; Northwestern University Dental School, 1915; died September 24; aged 49.

Overfield, M. S., Harlan, Iowa; State University of Iowa College of Dentistry, 1888; died May 31; aged 78.

Pitts, George W., Chicago, Ill.; Chicago College of Dental Surgery, 1895; died June 4; aged 62.

Riebe, P. A., Wausau, Wis.; Chicago College of Dental Surgery, 1891; died October 18; aged 82.

CORRECTION

Through a clerical error, the death of Dr. O. W. Elofson, Longmont, Colo., was announced in the November issue. We are pleased to learn that Dr. Elofson is in good health and continues in practice in Longmont.—Ed.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

Dental Protective Association of the United States, Chicago, December 19.

Sub-Section on Dentistry of the American Association for the Advancement of Science, Richmond, Va., December 28.

Five State Post Graduate Clinic, Washington, D. C., March 5-9.

Greater New York Dental Meeting, New York City, December 5-9.

National Board of Dental Examiners, December 2-3.

Chicago Dental Society, February 13-16.

Midwinter Clinic of Dallas County Dental Society, Dallas, Texas, January 30- February 1.

Greater Philadelphia Annual Meeting, February 1-3.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June, at the United States Public Health Service Auditorium, Washington.

Harvard Odontological Society of New York, December 9.

American Dental Society of Europe, Lausanne, Switzerland, August 7-9.

Congress of Australian Dental Association, Melbourne, August 21-26.

STATE SOCIETIES

February

Minnesota, at Minneapolis (21-23)

April

New Jersey, at Atlantic City (19-21)

May

New York, at New York City (9-12)
Tennessee, at Nashville (8-11)

June

Colorado, at Colorado Springs (22-24)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 5. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Connecticut, at Hartford, November 29-December 3. Almond J. Cutting, Southington, Recorder.

Louisiana, at New Orleans, December 14-17. Joseph L. Webre, 740 Audubon Bldg., New Orleans, Secretary.

New Jersey, December 5-10. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

Oklahoma, at Oklahoma City, December 14-17. W. T. Longwell, Frederick, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, December 6-10, W. A. McCready, 1115 Highland Bldg., Pittsburgh, Secretary.

South Dakota, at Sioux Falls, January 3-7. Carl H. Boyden, Mitchell, Secretary.

Wisconsin, at Milwaukee, December 12-16. S. F. Donovan, Tomah, Secretary.

COLORADO STATE DENTAL ASSOCIATION

The Fifty-Third Annual Meeting of the Colorado State Dental Association will be held at the Broadmoor Hotel, Colorado Springs, June 22-24.

R. L. CHRISTY, *Secretary,*
820 Majestic Bldg.,
Denver.

NEW JERSEY STATE DENTAL SOCIETY

The next annual meeting of the New Jersey State Dental Society will be held April 19-21 at the Ambassador Hotel, Atlantic City.

F. K. HEAZELTON, *Secretary,*
223 E. Hanover St.,
Trenton.

OKLAHOMA BOARD OF GOVERNORS OF REGISTERED DENTISTS

The Oklahoma Board of Governors of

Registered Dentists will hold its next examination December 14-17 in Oklahoma City. Applications must be filed at least ten days before the date of examination. For information and application blanks, address

W. T. LONGWELL, *Secretary,*
Frederick.

MIDWINTER CLINIC OF THE DALLAS COUNTY DENTAL SOCIETY

All ethical dentists of the Southwest who are members of the Texas State Dental Society or of the American Dental Association are cordially invited to attend the Twelfth Annual Meeting of the Midwinter Dental Clinic of the Dallas County Dental Society, to be held January 30-February 1 at the Hotel Adolphus, Dallas. Nationally known clinicians will be presented in a three-day course of lectures and practical demonstrations. The fee for the course, $15, includes a ticket to the banquet, January 31, where clinics will be presented by members of the Dallas County Dental Society. For additional information, address

THOMAS A. LIPSCOMB,
Medical Arts Bldg.,
Dallas.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK

The Seventy-First Annual Meeting of the Dental Society of the State of New York, component of the American Dental Association, will be held May 9-12 at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS, *Publicity,*
80 Hanson Place,
Brooklyn, N. Y.

SUB-SECTION ON DENTISTRY OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The meeting of the Sub-Section on Dentistry of the American Association for the Advancement of Science will be held in the Clinic Building of the Medical College of Virginia at Richmond, December 28, at 9 a.m. This year's meeting will consist of a conference on the cause of dental caries, based upon the reports of investigators in this field as now being collected by the Research Commission of the American Dental Association under the direction of William J. Gies. Thirty investigators in this field will make oral presentations of the summaries of their findings and an effort will be made to correlate these findings as far as possible. This meeting is open to members of the American Dental Association and an invitation is extended to them.

THOMAS J. HILL,
Western Reserve University,
2085 Adelbert Road,
Cleveland, Ohio.

ANNOUNCEMENTS

The Harvard Odontological Society of New York will hold its second annual luncheon at the Hotel Pennsylvania, December 9, in conjunction with the Greater New York Dental Meeting. All alumni are invited to attend. For further information address:

LOUIS KROLL,
39 Broadway,
New York City.

DENTAL INTERNSHIP

The Bronx Hospital (Fulton Ave. at 169th St., New York City) examination for a dental internship for one year beginning with July 1 will be held December 29 at 8:30 p.m. at the hospital. This is a modern hospital with a bed capacity of 310 for acute diseases. There is a very active outpatient department in all branches of dentistry, including periodontia, exodontia and oral surgery, orthodontia, radiography and operative dentistry. Hospital interns assist at oral surgical procedures under supervision of attendants in oral surgery at the hospital, for intern cases. Write for application form to the superintendent of the hospital.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A competitive examination to select not more than twenty for appointment in the Dental Corps of the Navy will be held July 5 at the Naval Medical School, Washington, D. C., Naval Training Station, Great Lakes, Ill., and Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States and must be between 21 and 32 years of age at the time of appointment, a graduate of a standard dental college, of good moral character and of unquestionable professional repute. Credentials relative to character, citizenship, date of birth and education must

be submitted and approved before an applicant can be authorized to appear for examination.

Senior students in dental colleges may submit applications to appear for the examination held next after their dates of graduation. They should submit with their applications and credentials a letter from the dean of their dental school stating that they are members of the senior class and, immediately after receiving their diplomas, a letter from the dean or registrar of the dental school that they have received the degree of doctor of dental surgery or doctor of dental medicine as the case may be.

A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, REGULAR ARMY

An examination for the selection of candidates for appointment in the Dental Corps, Regular Army, will be held during the period February 13-18. The examination, which will include both physical and professional examinations, the latter consisting of written, oral and clinical tests, is open to male citizens of the United States between the ages of 22 6/12 and 31 9/12 years at the time of the examination, who are graduates of acceptable dental schools and who have had at least one year and eleven months subsequent practice in their profession.

Full information and application blanks will be furnished on request to the Adjutant General, War Department, Washington, D. C. Applications will not be considered after January 31.

XI PSI PHI FRATERNITY, GOLDEN ANNIVERSARY

The Golden Anniversary Celebration of the founding of Xi Psi Phi will be held at Ann Arbor, Mich., February 8-9. A program has been arranged which includes the unveiling of a memorial on the campus of the University of Michigan in commemoration of the founding. The founders will be guests of honor. All Xi Psi Phi's are urged to attend this notable event.

J. Floyd Alcorn, *General Secretary,*
Golden Anniversary Committee,
3720 Washington Blvd.,
St. Louis, Mo.

CONGRESS OF THE AUSTRALIAN DENTAL ASSOCIATION

The Congress of the Australian Dental Association will be held in Melbourne August 21-26. The main object of the Congress is the presentation of papers, clinics and demonstrations, but facilities will be afforded for formal and informal social gatherings. Representative delegations will attend from all states of the commonwealth and from New Zealand. Eminent members of the profession from abroad have expressed the intention to attend.

W. A. Morrison, *Chairman,*
Publicity Committee,
Melbourne.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING OCTOBER 1938

October 4

Re. 20,877, to Charles H. Prange. Cast metallic denture.
No. 2,131,807, to Henry Jerum. Dental bur holder.
No. 2,131,940, to Reiner W. Erdle. Denture.
No. 2,131,941, to Reiner W. Erdle. Denture.
No. 2,132,116, to Henry R. Kiepe. Alloy.
Des. 111,609, to Robert L. Lasater. Design for a rubber toothbrush.

October 11

No. 2,132,763, to Arthur E. Smith. Hypodermic syringe.

October 18

No. 2,133,295, to Ernest L. Hollenbeck. Fountain brush and tube holder.
No. 2,133,332, to Oscar H. Pieper. Dental unit.
No. 2,133,699, to J. A. Heidbrink. Inhaler.
No. 2,133,704, to Fred A. Jones. Tooth brush.

October 25

No. 2,134,144, to Douglas F. Pincock. Hypodermic syringe.
No. 2,134,145, to Douglas F. Pincock. Ampule.

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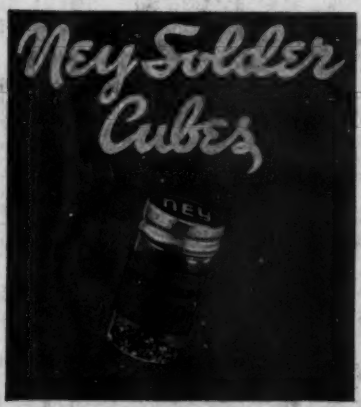

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